SAN FRANCISCO BAY AREA REPORT

SOLID WASTE MANAGEMENT AND THE BAY AREA FUTURE

Solid Waste Management And The Bay Area Future

A Report of
The California Refuse Removal Council
Northern District

Recycled Paper

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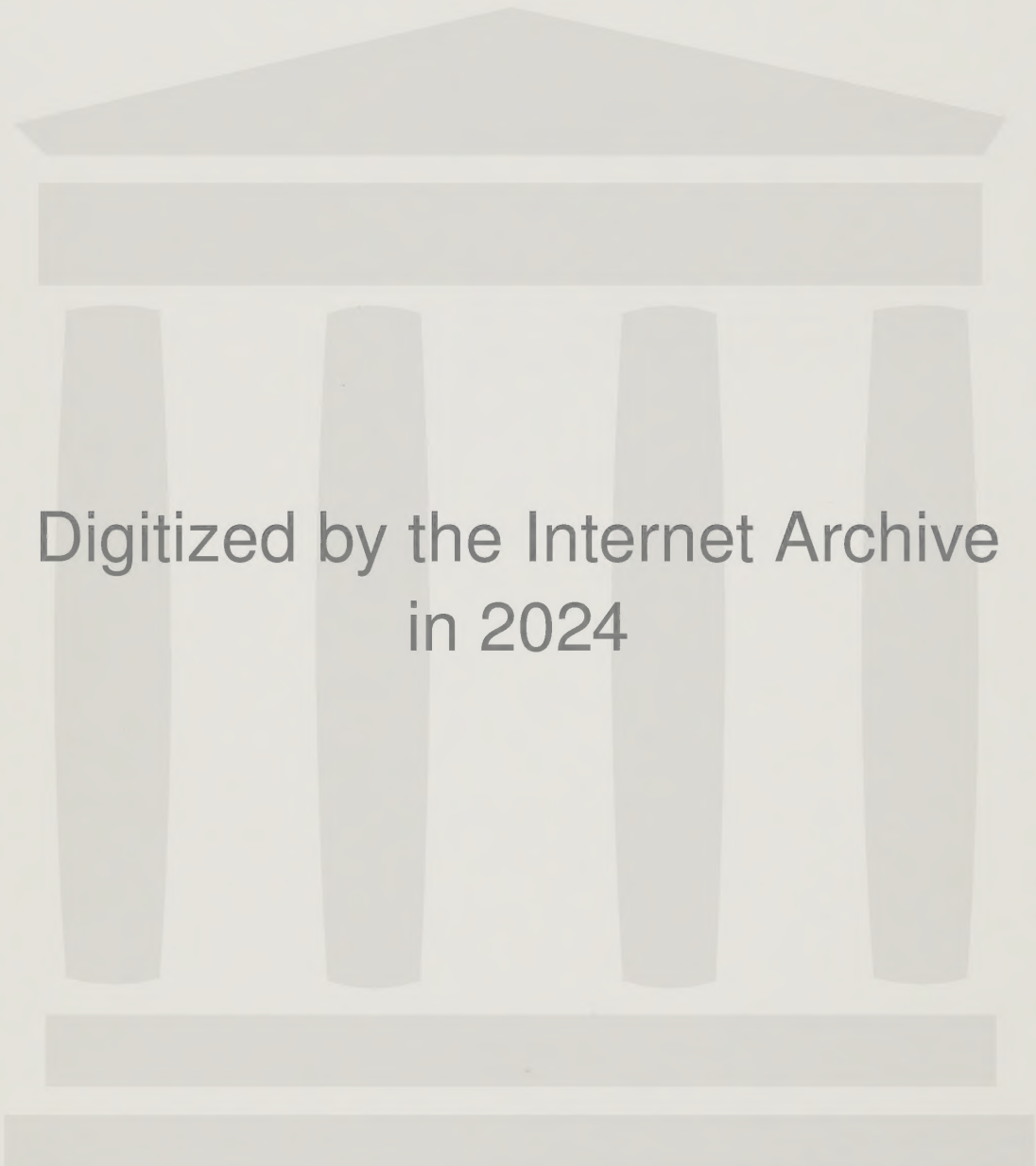
SOLID WASTE AND THE BAY AREA FUTURE
SAN FRANCISCO BAY AREA REPORT, FIRST EDITION

PHOTOGRAPHS ON TITLE PAGE:

The four steps in the solid waste management process clockwise:

Waste Collection (Photo courtesy Sunset Scavenger Co.)
Transfer Station (Photo courtesy Solid Waste Engineering and Transfer Systems)
Sanitary Landfill (Photo courtesy Easley & Brassy Corp.)
Paper Recovery (Photo courtesy Sunset Scavenger Co.)



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INTRODUCTION

In recent years there have been a number of developments affecting the solid waste management industry within the Bay Area and throughout the State. Rapid environmental, technical, legislative, and demographic changes have occurred that require a reassessment of the conclusions and recommendations of earlier reports. Moreover, recently prepared proposals and reports need wider dissemination and careful evaluation.

Because of the important need to summarize and assess the effects that these new developments will have in providing refuse collection and disposal service to the people of the State, the California Refuse Removal Council, Northern District, (CRRC) has initiated this report. The Council represents the private sector of the solid waste management industry. This industry—the refuse collection companies, disposal site contractors, liquid waste haulers, the secondary materials industry, and equipment dealers—is responsible for most of the solid waste management in the Bay Area. This is typical throughout the nation where the private sector handles nearly 75 percent of all solid waste collected.

To set forth the best solutions for solid waste management in the Bay Area for the coming decades, a first-hand survey and evaluation was made of current waste disposal practices. The findings of the survey were combined with population forecasts and other social and demographic factors to yield an estimate of Bay Area regional disposal needs between now and the Year 2010. To plan on a manageable scale, the Bay Area was divided into 14 planning areas. These areas are defined by geographical features, collection franchise boundaries, and county lines. Each planning area is described in this report in terms of the current state of solid waste disposal as well as present and future population and waste generation forecasted through the 38-year planning period to 2010. On the basis of these forecasts, solutions are proposed for handling increasing amounts of solid waste with a combination of existing and new landfill sites, resource recovery facilities, and transfer stations.

The report also includes a historical review of waste management in the Bay Area, a comment on the roles of government and private industry in solid waste management with descriptions of recently adopted and currently proposed Federal and State legislation, and a description of the solid waste management process including an assessment of the state of resource recovery projects and experimental disposal methods. On the premise that sanitary landfill is now—and will continue to be—the most realistic method of waste disposal, requirements are outlined for operating a quality landfill with recommendations for operating standards to provide maximum environmental protection.

It is apparent that many aspects of solid waste management still need to be studied and resolved, especially at this time when the seemingly competing, often clashing realities of environmental protection and the necessity of disposing increasing amounts of solid waste both must be faced realistically. To aid in this endeavor, this report has been prepared as a tool for public administrators and private industry leaders responsible for planning and decision-making to provide an up-to-the minute account of solid waste disposal practices and future needs in the Bay Area.

RECOMMENDATIONS

These recommendations have evolved from the findings of the Bay Area Survey and the study which followed it. They are considered vital if modern, efficient, economical solid waste disposal is to be a reality for the San Francisco Bay Area.

IMMEDIATE ACTIONS

Counties and private industry should expend every effort to reserve large capacity sanitary landfill sites for future use by residents of the Bay Area. Land acquisition programs should begin immediately to set aside sufficient waste disposal property that can later be used to provide open space and recreational areas for years to come.

As landfill sites near urban centers close and new sites are located at greater distances, more transfer stations should be provided where local collectors can bring refuse to be transferred to larger-capacity trucks for economic long-distance haul. These transfer stations should be convenient to the general public as well as franchised collectors, should be located away from incompatible activities, and should be designed to the highest standards with landscaping integrated into the total site.

Resource recovery facilities should be an integral part of transfer stations where materials can be reclaimed and recycled to help conserve dwindling natural resources and to reduce the amount of waste ultimately disposed.

PLANNING

Continuing planning is essential for Bay Area solid waste management. At least every five years, handling practices need to be updated and resurveyed to keep industry members current with changing conditions. By developing five-year records, accurate population and refuse generation trends can be established and evaluated in terms of the most recent disposal methods to forecast future waste disposal requirements.

CRRC urges industry members to cooperate closely with counties in developing the county solid waste master plans due in 1976, as required by California State law. These plans should be developed within the framework of a Bay Area regional solid waste master plan prepared by the California Refuse Removal Council to reflect workable industry technology.

Special planning and investigation are needed to improve methods of handling hospital and clinical wastes. Active participation by CRRC in this area and in sponsoring new legislation dealing with standardized procedures is important.

In the area of liquid waste disposal, a program should be implemented to build a series of liquid transfer stations. Landfill operators should begin working with liquid waste haulers and Class I disposal site operators to establish transfer points so industrial liquids can be hauled safely to Class I disposal sites.

GOVERNMENT

Local governments must work together to create better, more economical solutions through regional approaches. CRRC urges the removal of antiquated laws which restrict the movement of waste across city or county lines and advocate new legislation allowing refuse to be moved wherever it can be disposed in the most environmentally protective manner.

Legislation should be enacted requiring mandatory collection from all residences to reduce litter, indiscriminate dumping, and public health and nuisance problems.

ENGINEERING AND DESIGN STANDARDS

The California Refuse Removal Council encourages the development of uniform engineering and design standards for sanitary landfills. As an industry-wide practice landfills should be designed for optimum site utilization. Perimeter wells for water and gas monitoring should be an integral part of each site with periodic analysis and reports.

OPERATING AND SAFETY STANDARDS.

Operating procedures must be improved to bring many disposal site operations up to acceptable environmental and safety standards. As minimum day-to-day operating standards, private industry should adopt the EPA Guidelines for Land Disposal of Solid Waste as proposed in April 1973 to assure the protection of California's vital water, land, and air resources.

Operating personnel must be trained in proper methods of spreading, compacting, and covering to attain sanitary landfill. In compliance with the new Occupational Safety and Health Act (OSHA) regulations demanding on-the-job safety, industry members should implement active safety programs to assure customer and employee safety in both the field and shop.

RESEARCH AND DEVELOPMENT

Recognizing that new waste handling and disposal methods are continually being developed, CRRC encourages an active research and development program. Studies could include landfilling shredded waste and sewage sludge mixed as a soil conditioner. Leachate production and gas movement studies related to water pollution could be furthered. A demonstration resource recovery plant is needed to optimize the mechanical system and to develop marketing outlets suitable to Bay Area demands. Investigation should be initiated into the feasibility of using Bay Area solid waste to generate electrical energy in existing power plant facilities. Continual review and reporting is needed of worldwide and national research to determine what can be applied in the Bay Area.

EDUCATION

Defining the role of the member companies of CRRC to the general public is important. Appearances at Lions, Rotary, and other community service group meetings to describe how private industry works in solid waste management is vital. Grammar and high school education programs are needed to describe the operations basic to good solid waste management. CRRC encourages the initiation and development of these programs using a variety of methods including slides, tours, and special and periodical publications.

On-going education programs describing resource recovery, energy conversion, transfer stations, and sanitary landfills will create an informed public before controversies arise over new handling and processing facilities and sanitary landfill sites. CRRC urges its members to be public educational spokesmen providing facts to describe the entire solid waste management process—from garbage collection to final disposal.

HISTORY

During the early history of San Francisco in the late 1800's garbage and refuse collection was left to individual collectors, or scavengers, who established and maintained their own routes. With only horses and wagons for equipment, Italian immigrants found steady work collecting garbage. Food wastes were hauled to hog farms and other refuse was dumped in low-lying areas near the waterfront and Cow Hollow where it was burned in open fires.

Since there was little official supervision from the City, customers were frequently pirated from routes. This caused many disputes among the scavengers, resulting in irregular collection and unhealthy conditions. In the early 1920's, the City of San Francisco issued, in effect, an ultimatum to the scavengers, warning them that the City would step in and take over the job unless they settled their own differences.

VALLEJO GARBAGE SERVICE PHOTO

As a result, two cooperatives were formed by dividing the City into two parts. These firms, known today as the Golden Gate Disposal Company and the Sunset Scavenger Company are still the only two serving San Francisco residents.

As the Bay Area grew, members of the San Francisco companies moved to new areas around the Bay to start their own business. One company, the Oakland Scavenger Company, developed into the largest independent collection company in California and one of the largest in the country. Today this company serves nearly every community along the Bay in Alameda County and operates thirteen divisions dealing with collection, landfill, land management, paper stock recovery, and other related activities. Other major companies formed in the City of San Jose, and Contra Costa, San Mateo, and Marin Counties.

In the early days, even through the 'twenties,' the horse and wagon were used exclusively for collection. But by the 'thirties they had generally been replaced by open trucks. The earliest models were the De Martini, developed and built by the scavengers. Through the years, the open top truck was used with improvements in engine and chassis design. The scavengers found this a convenient vehicle for segregating refuse into various components as it was collected. By the end of the route, bottles, rags, paper, and cans were in separate piles ready for marketing. The open top trucks continued to be used by many companies into the mid 'sixties when the economics of collection dictated the use of packer trucks. These trucks eliminated any possibility of segregating materials in the process of collection.

Early operations in the Bay Area employed a variety of disposal methods—hog farms, incineration, composting operations, open burning and sanitary landfill with barge and rail used for hauling as early as 1932. During the ensuing years, landfills emerged as the ultimate disposal sink. Bay filling, the most economical solution for waste disposal, provided new land for commercial and recreational use. But today's environmental concern for San Francisco Bay is rapidly ending Bay fill operations and requiring disposal sites located further from the Bay and metropolitan centers. Now modern systems transfer and haul waste to outlying sites. Resource recovery operations are being incorporated into major transfer stations to recycle valuable materials and reduce the amount of residue for final disposal. These solutions ensure environmentally sound, non-polluting methods of handling waste and maintain user costs at the low levels they have enjoyed for years.

Throughout the past half century, the Bay Area scavenger companies have had very little change in their basic corporate structures. Until recent years, companies were owned and controlled by the working shareholders. Today, third generation Italian-Americans are managing most Northern California waste disposal companies.

On the national scene, a new trend is beginning. In the past three years, several agglomerates have appeared, acquiring many companies under single corporate umbrellas. Although two major Bay Area companies have already joined one of these national companies, it is still too early to assess the effect of these actions, but undoubtedly some noticeable changes in management philosophy will be seen. The personal quality of predominantly Italian-owned and operated companies in Northern California may give way to the faceless anonymity of giant corporations.

SOURCE MATERIAL

Casey, John J. "Refuse by Sanitary Fill Method at San Francisco," *Civil Engineering*, 9 (October 1939).

REGIONAL PLANNING

Refuse disposal is a regional problem requiring interjurisdictional cooperation. How refuse is disposed in one county or city can affect the air and water quality in another. The few cities and counties that have no disposal facilities within their legal boundaries must look to their neighbors for help.

Some regional waste disposal programs are already in effect in the Bay Area. Marin County waste is hauled to the West Contra Costa Site in Contra Costa County. The American Canyon Sanitary Landfill serves both southern Napa County and Vallejo in Solano County. The Acme Fill Corporation site in Contra Costa County serves most of the central portion of that county as well as the City of Benicia in Solano County. And, in Santa Clara County, the City of Mountain View is building a regional park from waste transferred from the City of San Francisco. Other regional programs include the Santa Clara County-San Benito County cannery waste disposal project and the San Jose liquid waste transfer station.

In the San Francisco Bay Area there are currently 64 active landfill sites and three transfer stations. In a few short years East Bay Cities will face a shortage of nearby landfill space. Other cities around the Bay will also experience similar situations at later dates. As local sites fill and close, new sites must found to accomodate the ever-increasing amount of wastes produced. And as land becomes increasingly expensive it will cost more to haul waste greater distances to ample and relatively inexpensive sites. Transfer stations, incorporating resource recovery at every opportunity, will be needed to move waste as efficiently and economically as possible from where it is generated to its final disposal.

Surprisingly, there are still laws on the books restricting movement of wastes across city or county lines. To make regional solid waste management a reality these laws will have to be replaced by legislation more in tune with contemporary reality.

1972 SURVEY

In 1972 the Staff of the State Department of Public Health and Easley & Brassy Corporation jointly conducted a survey to obtain first-hand information of Bay Area land disposal sites which handle 97 percent of the region's 14,000 tons of daily waste. The Survey also identified the wastes that are collected and brought to these sites and determined the waste generation rates for different population centers. In all, 60 Bay Area operating landfill sites were visited in the 1972-

1973 period and a personal interview was conducted with the owner or site operator using a detailed questionnaire developed by the Department of Public Health.

The major wastes identified in the survey included municipal, commercial, industrial, liquid industrial, demolition, canning, and other wastes associated with modern urban life. The survey did not attempt to identify or include wastes produced by agricultural activities which account for nearly one-half of the solid waste produced in California. These wastes — principally manures and crop residues — are usually returned to the soil or burned in the fields.

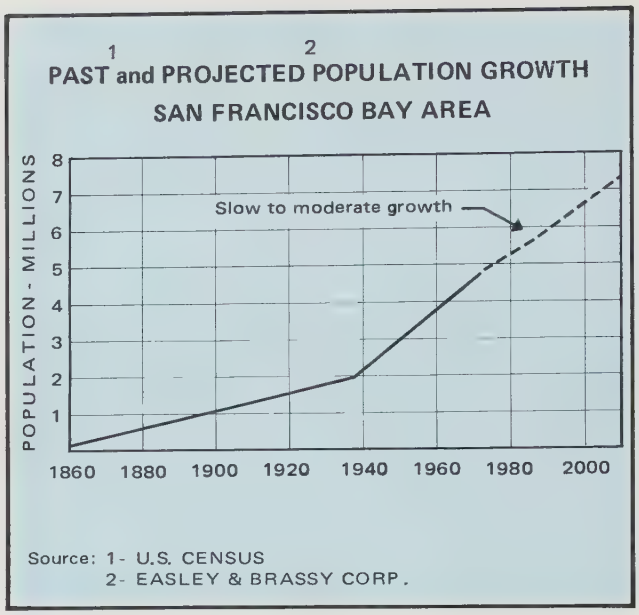
Information from the survey is presented in the disposal site descriptions in the Planning Area Section. Amounts of waste received at sites are expressed in tons although few operations regularly use truck scales. Annual tonnages at each site were determined by using average weights for various truck sizes at those sites with truck scales and correlating these weights with truck counts and customer use at other sites.

BAY AREA ANALYSIS

Combining the waste generation and site capacity information gathered in the 1972 Survey with population and waste production forecasts, a detailed analysis was made of the movement of Bay Area waste from where it is generated to its final landfill disposal. This analysis, based on a computer program written as a solid waste management forecasting model for the period from 1972 to 2010, deals with population forecasts, waste production trends, sources of waste, transfer stations, and disposal sites in the Bay Area.

Population Forecasts

During much of the nineteenth century, the San Francisco Bay Area accounted for nearly all of the population in Northern California. With the discovery of gold in El Dorado County in 1848 came the first population boom experienced in California. San Francisco, as the major port and jumping-off place for the gold seekers, soon became the trade, manufacturing, and financial center of the West. By the 1860 Census the State's population was concentrated in the Bay Area. Following the Gold Rush, the completion of the first transcontinental rail line in 1869 gave an additional boost to the area's growth by bringing better communication, reduced shipping costs, and more convenient, less costly travel for eastern in-migrants to Northern California.



While population continued to grow steadily during the remainder of the nineteenth century and into the early decades of this century it was interrupted during the Great Depression of the 1930's. With World War II, vigorous immigration resumed. The decrease at the close of the war was only temporary as the Korean War in the early 1950's set off a new influx. By 1970, the Census showed the nine-county area with a population of 4,628,199.

In recent years, consistent with the trend happening in virtually all metropolitan areas across the nation, this growth has tapered and shifted from the central cities to the suburbs. Before 1950 most of the Bay Area population growth occurred in San Francisco and Oakland and spread up and down the Bayshore. While these two central cities remain important employment centers both have experienced slight population declines since 1950.

While suburban Marin and Contra Costa Counties have more than compensated for the population losses of the central cities, the major Bay Area growth in the last 20 years has been concentrated in the South Bay — southern Alameda and Santa Clara Counties. Elsewhere, in the region, most of the land along San Mateo's Bayshore has been developed with much of the current growth occurring in the hills and along the Coast.

Although the nine counties account for only four percent of the total land area in California, they house nearly one-quarter of the State's residents. The 7,501 square-mile area has a larger population than 37 states and the District of Columbia. During

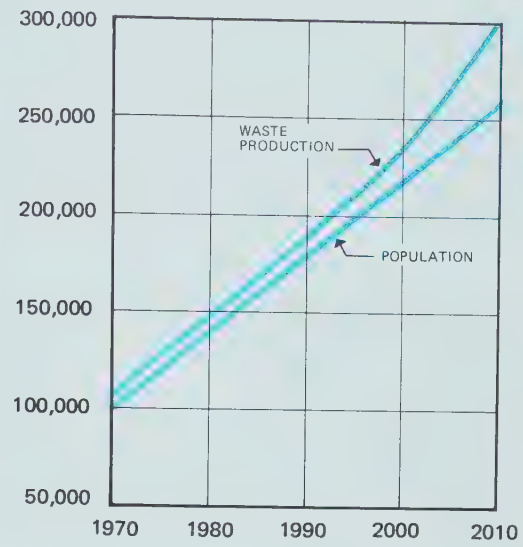
the last decade, the region attracted an average of nearly 99,000 residents annually with in-migration accounting for approximately half of the growth. Despite these impressive population figures the region is by no means totally urbanized. Nearly three-quarters of the total land remains rural and the substantial amount of open space close to urbanized areas is one of the factors which makes the Bay Area a particularly attractive place to live.

In the coming decades many changes will shape the growth of the Bay Area. In the forecasts projected in this study an overall slow-to-moderate growth rate was projected. Thus the 1970 population of 4,628,199 is expected to reach 7.6 million by 2010.

Waste Production Forecasts

Estimating solid waste production is a dilemma. On the one hand, the expanding population and increased affluence of a convenience-oriented society demanding more and more packaging would indicate increased materials per capita for solid waste production. On the other hand, there are new drives to reduce the amount of waste we produce. Less packaging is one aim. And, on the horizon, revolutionary communications systems would greatly diminish the demand for newspapers and magazines with second-and-third-generation television and electronic devices. However, despite these efforts, it was assumed for this analysis that per capita waste production would continue to rise during the planning period. An annual increase of one percent was used to forecast future waste generation.

EFFECT OF A ONE PERCENT ANNUAL INCREASE IN THE BASE PER CAPITA WASTE PRODUCTION FACTOR



Source: EASLEY & BRASSY CORP.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
SAN FRANCISCO BAY AREA

PLANNING AREA	1970	1980	1990	2000	2010
WEST MARIN	9,000	11,158	13,859	16,560	19,260
EAST MARIN	203,276	242,124	284,980	329,112	373,046
SONOMA NORTH COASTAL	1,000	1,370	1,750	2,100	2,500
CENTAL SONOMA	188,634	271,314	367,774	464,283	560,691
NORTHEAST SONOMA	15,251	19,929	25,719	31,509	37,399
NAPA VALLEY	9,873	12,245	15,128	18,012	20,894
NAPA-SOLANO	193,057	247,823	337,147	426,472	504,797
EAST SOLANO	37,577	48,185	62,499	77,675	92,278
CENTRAL/EAST CONTRA COSTA	372,389	431,163	537,803	643,426	755,805
WEST CONTRA COSTA	195,308	234,901	275,270	325,626	371,023
ALAMEDA	1,073,984	1,187,076	1,337,957	1,495,241	1,648,828
METROPOLITAN SAN JOSE	1,029,734	1,164,198	1,296,493	1,429,840	1,563,217
SOUTH SANTA CLARA	32,303	51,669	79,382	107,572	135,702
SAN FRANCISCO and PENINSULA	1,266,813	1,326,821	1,399,481	1,471,566	1,541,462
TOTAL	**4,628,199**	**5,249,976**	**6,035,242**	**6,838,994**	**7,626,902**

Source 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

Waste Sources

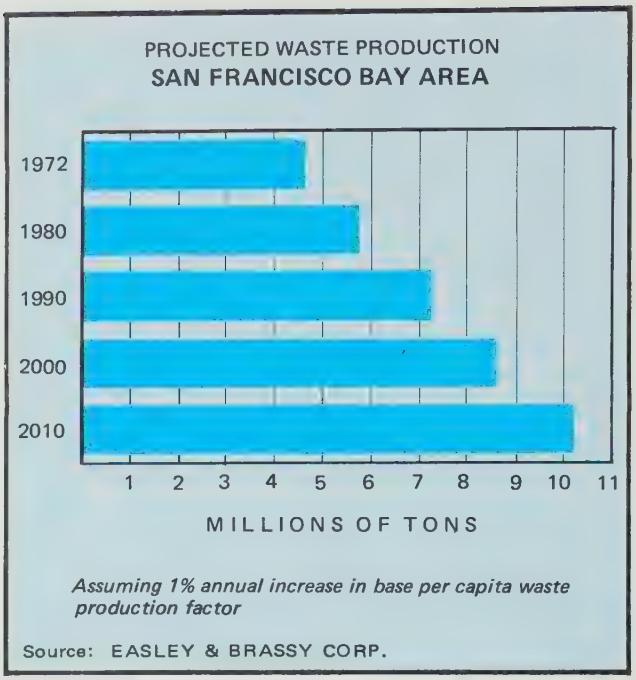
The waste generation sources used in the analysis included each of the incorporated cities in the Bay Area, other smaller communities, unincorporated county areas, and special sources of waste. Each of the 120 sources was assigned certain base data for computer evaluation. This data included the source name and code number, 1972 population, a population growth factor, a per capita waste production factor, the waste production growth factor, the landfill site currently used, and as many as four alternate disposal sites when the current site fills.

Populations of cities and unincorporated county areas were based on the 1970 U.S. Census updated with the latest information available from counties and cities. Similarly, the population growth factor was based on available county and State of California Department of Finance projections evaluated and interpreted by Easley & Brassy Corporation staff. The population growth factor, expressed in terms of percent yearly growth of the base population, varies for each source.

The per capita waste production factor, based on the results of the 1972 Survey, was calculated on the basis of annual tonnage figures at each disposal site and the corresponding cities and areas using the site. The 1972 average throughout the Bay Area was one ton per capita annually or 5.5 pounds per day. This rate varied from less than half a ton per capita per year (2.3 pounds per capita per day) in some communities to over one and a half tons per capita per year (7.8 pounds per capita per day) in others. Some of this variation is attributed to geographical location of the city, socio-economic status of residents, and the amount of industrial activity. Each of the source areas was assigned a per capita production factor tailored to its circumstances.

For each source the analysis identified the landfill presently used and specified as many as four additional disposal sites that could be used when the current site is exhausted. The alternate disposal sites are identified by a code number and a travel time expressed in minutes. Thus, the source can use the next available landfill with the least travel time when its present site is completed.

Where transfer stations are—or will be—used, projections were made on the basis of reduced amounts of final disposable waste to account for resource recovery efforts. For example, if a city generating 500,000 tons of waste annually uses a transfer station with resource recovery facilities, a reduction factor of 5 percent was applied to projected waste flow to estimate a recovery rate of 25,000 tons leaving 475,000 tons to be landfilled.



Disposal Sites

The computer analyzed 74 waste disposal sites—60 in operation, 4 proposed and 10 reserve capacity—predicting the fill rate, the cities that will eventually use each site, and expected closure dates. With the appropriate data for each city and disposal site as input, the computer analyzed waste movement in the Bay Area from 1972 to 2010.

As with the waste generation sources, each landfill site was assigned certain base data. Landfill code numbers 1 through 74 were assigned for use in the computer program. A landfill map number was also assigned on the basis of a site numbering system adapted from the State numbering system. In brief, each of the nine Bay Area counties was assigned a hundred number in the series 100 through 900 beginning with Marin County (100's) and ending with San Francisco County (900's). Landfills were assigned two digits following the hundred series digit. These digits correspond to numbers assigned by the State Department of Public Health in 1968 and updated in 1972. Thus, in Contra Costa County (500's), the Pittsburg Disposal Site is 501 and the Antioch site is 502. Military installation landfill sites were placed in the 50 series so, for example, the Mare Island Naval Shipyard in Solano County (400's) was assigned 451. Future or proposed sites were placed in the 90 series so that the Contra Costa County Reserve Capacity Site is 590.

The Disposal Site Data includes the tonnage capacity remaining at each site based on the 1972 Survey and, in some cases, more recent information. Tonnage capacity is used throughout the computer program to correspond to the tonnage generation factor used by the cities. Tonnage capacity figures were calculated for each site from the information provided during interviews with site owners and operators. The useable acres remaining in each landfill site were multiplied by the planned depth of fill and an acre-foot capacity was determined. These acre-foot capacities were converted to tonnage capacities using information about the operation including terrain and type of equipment used. This provided a waste density conversion factor for each site.

In some planning areas, it was recognized that all available landfill capacity will be exhausted by the Year 2010. To account for all the waste generated in a planning area, reserve capacity sites were introduced into the program. The assigned maximum capacities for these sites were 999,999,999 tons which far exceeds the chance of ever being filled. By simple subtraction, the reserve capacity requirements of each planning area were determined.

WASTE DISPOSAL FACILITIES INCLUDED IN BAY AREA ANALYSIS

Site Name	Department 1 of Public Health No.	California 2 Refuse Removal Council No.
West Marin Planning Area		
West Marin Sanitary Landfill	2105	105
East Marin Planning Area		
Redwood Sanitary Landfill	2101	101
San Quentin Disposal Site	2102	102
Ghilotti	2106	106
Future Transfer Station	—	1T1
North Sonoma Coastal Planning Area		
Annapolis	4916	216
Central Sonoma Planning Area		
Sonoma Refuse Disposal Area	4901	201
Guerneville Refuse Disposal Area	4906	206
Occidental	4907	207
Central	4917	217
Northeast Sonoma Planning Area		
Healdsburg	4904	204
Napa Valley Planning Area		
Upper Valley Disposal Site	2801	301
Del Santi	2808	308
Napa-Solano Planning Area		
American Canyon	2804	304
Solano County Sanitary Landfill	4804	404
Fairfield Disposal Site	4803	403
J&J Disposal Site[3]	1	4I1
Travis Air Force Base	—	450
Mare Island Naval Shipyard	—	451
Potrero Hills Proposed Site	—	490
Future Fairfield Transfer Station	—	4T1
East Solano Planning Area		
Dixon Disposal Site	4806	406
B&J Disposal Site	4807	407
Rio Vista Sanitary Landfill	4808	408
J&J Disposal Site II	—	4I2
Central/East Contra Costa Planning Area		
Pittsburgh Disposal Site	0701	501
Antioch Dump	0702	502
Acme Fill Corporation	0704	504
Industrial Tank-Martinez	—	5I1
Industrial Tank-Pittsburg[2]	2	5I2
Reserved Capacity Site	—	590
West Contra Costa Planning Area		
West Contra Costa County Dump	0707	507
Alameda Planning Area		
Albany Landfill	6001	601
Berkeley Landfill	6002	602
Alameda City Disposal Site	6003	603
Davis Street	6004	604
Marina Disposal	6005	605
Hayward Disposal Site	6006	606
Turk Island Company	6011	611
Fremont Site	6012	612
Eastern Alameda County Disposal Site	6013	613
Pleasanton Public Dump	6014	614
Alameda Naval Air Station	—	650
Kaiser-Radum Pits	—	690
Future Oakland Transfer Station	—	6T1
Future Hayward Transfer Station	—	6T2
Metropolitan San Jose Planning Area		
Palo Alto Landfill	4301	701
Mountain View Disposal Site	4302	702
Stierlin Road Disposal Site	4303	703
Sunnyvale-Specialty Site	4304	704
All-Purpose Landfill	4305	705
Filldump Improvement	4306	706
Nine Par Disposal Site	4307	707
Newby Island Site	4308	708
Singleton Road Disposal Ground	4311	711
City of San Jose Disposal Grounds	4312	712
Guadalupe	4314	714
G&M Construction	4319	719
South Santa Clara Planning Area		
Morgan Hill Site	4315	715
Pacheco Pass	4316	716
Gilroy Site	4317	717
San Martin	4318	718
San Francisco and Peninsula Planning Area		
Burlingame Disposal Site	4103	803
San Mateo Disposal Site	4104	804
South County Disposal District	4106	806
Hillside Rubbish	4107	807
Junipero Serra Site	4108	808
Daly City Disposal Site	4109	809
Half Moon Bay Disposal Site	4112	812
Pescadero Disposal Site	4114	814
Marsh Road Sanitary Landfill Site	4115	815
Ox Mountain Sanitary Landfill Site	—	890
San Bruno Transfer Station	—	8T1
South San Francisco Transfer Station	—	8T2
San Francisco Transfer Station	—	9T1
Future San Mateo Transfer Station	—	8T3

1. Status of Solid Waste Management in California, 1968 with 1972 numbers added by staff.
2. Easley & Brassy Corp.
3. Hazards Waste Disposal Survey, 1971—State Department of Public Health.

FUTURE WASTE MANAGEMENT

Municipal and Residential Disposal Needs

Currently 64 waste disposal landfill sites and three transfer stations serve the Bay Area. In the next few decades many of these landfill sites will fill and by 2010 most will be closed. To accomodate increased waste generated by more people, a combination of larger sites and more transfer stations will be needed. Ultimately about 18 landfills, mostly new ones with a few existing sites continuing operations, and about 11 transfer stations will be scattered throughout the Bay Area to handle waste on a regional basis. Although some of the sites—West Marin, Annapolis, Guerneville, Healdsburg, and Upper Valley—will be small because of the sparsely populated areas they serve, most of the newer landfills will be considerably larger than existing sites. In general they will be capable of handling from a half to one and a half million tons of waste a year.

With fewer landfills—and many of these in outlying areas distant from populated places—more transfer stations will be needed where local collectors will bring refuse to be transferred to larger-capacity trucks for economic long-distance haul to the sites. As necessity mounts to recycle materials, resource recovery facilities will be incorporated into these transfer stations to reclaim usable goods before the residue is loaded for the final disposal haul.

In general, most Bay Area counties have the land capacity to accomodate their own solid waste throughout the planning period until 2010 although new sites will be located in outlying areas more distant from waste sources than current sites. San Francisco, however, exhausted all its landfill capacity in 1970 and since then has been transferring its waste to Mountain View (702) in Santa Clara County. More land is available in the South Bay for filling to serve San Francisco needs until about 1987. After that time, as a possible alternate, San Francisco may divert its refuse to the Ox Mountain Site (890) in San Mateo County in the late 1980's.

Another instance where counties will continue to work on a regional basis is the Napa-Solano planning area where the American Canyon Sanitary Landfill already receives waste from Vallejo and unincorporated areas in Solano County in addition to refuse from Napa. This site will also probably serve the Fairfield area when the Fairfield Disposal Site (403) closes around 1989. If the American Canyon expands its present site it could continue to handle waste on a regional basis until 2050.

Elsewhere in the Bay Area, counties have capacity in their own existing landfills or in rural land within county boundaries as well as convenient sites for transfer stations where needed. In Marin County the coastal corridor will continue to be served by the West Marin Sanitary Landfill (105) near Point Reyes Station. But the eastern—or Bay—side of Marin will need a new landfill about 2001. In the meantime, in the mid-1980's, a transfer station (ITI) will be needed immediately north of Corte Madera.

Sonoma County will continue to operate about five landfills for its scattered population. Annapolis (216), Guerneville (206), Central (217), and Healdsburg (204) will all be sufficient through the Year 2010. Action is now pending on a replacement site near Sonoma for the Sonoma Refuse Disposal Area (201). When the Occidental site (207) is phased out of operation in mid-1974, it may be converted to a transfer station with waste hauled to Central.

In the East Solano County area, the B & J Drop Box Site (407) will be the major site with sufficient capacity for Vacaville, Dixon, and Rio Vista until 2005. An extension of this site would be needed to accommodate 600,000 tons of waste forecast between then and 2010.

Contra Costa County will see the West Contra Costa Dump (507) close about 2020. The Acme Fill Corporation Site (504) will last until about 2001 with adjacent property available for use beyond that time.

Alameda County will experience the most drastic changes. Beginning about 1977 a transfer station (6T1) will be used for waste hauled from the Metropolitan Oakland area. About the same time a second transfer station (6T2) may be necessary depending on the outcome of permit applications for the West Winton Avenue Site (606) near Hayward. By 2010 Alameda County will have only one or two active landfill sites with two or three transfer stations.

Santa Clara County faces a similar situation. Although there are now 16 landfill sites, by 2020 only two or three major sites will be operating in combination with one or two transfer stations.

San Mateo County currently has two transfer stations in operation. One more is planned (8T3) near Belmont and waste transfer is scheduled for disposal in the Ox Mountain Site (890). All other sites in the County will be closed by 2000 so that Ox Mountain will serve the entire County.

BAY AREA WASTE DISPOSAL FACILITIES
EXISTING AND PLANNED

Hazardous Waste Disposal

In addition to the continually increasing flow of regular refuse and trash, hazardous wastes are also produced. These require special disposal treatments and final sites. In the Bay Area there are five hazardous waste disposal sites. They are centered in the heavily industrialized area along the east side of San Pablo Bay and in northern Contra Costa County where the heaviest concentration of liquid wastes are produced in the Bay Area.

These sites are classified by the Regional Water Quality Control Board as Class I*. They are operated to completely protect ground and surface water supplies, public health and wildlife resources. The natural geologic conditions in these sites must prevent vertical and lateral hydraulic continuity between liquids or gases. These sites cannot be over an active fault zone and must be located to avoid inundation and washout.

The lack of any Class I disposal sites throughout the rest of the Bay Area poses problems. The long haul to existing sites has resulted in numerous instances of illegal dumping. Hazardous wastes are often left on abandoned lots or poured into sewers. Small amounts concealed with other wastes are sometimes hauled into Class II sites jeopardizing the safety of equipment operators.

Solutions are being worked out on the state level. A positive step has already been taken by licensing haulers. Another approach is to establish more Class I disposal sites around the Bay. But finding sites with the required topographical and geological conditions will be difficult. Not only are they scarce, but the necessity to isolate them from population centers, screen them from view, and control odors and noise are difficult conditions to meet.

Building a few new, well-located liquid transfer sites appears to be the most likely solution to managing hazardous wastes for the Bay Area. Property adjacent to industrial areas could be used as holding places for these materials where waste deposited by local liquid waste haulers would be collected and transferred to existing Class I sites. Transportation would be simplified by using large tank trucks to haul waste instead of small, ill-equipped trucks. Convenient local transfer sites would reduce the incidence of illegal dumping.

The City of San Jose has already begun on this program of local liquid transfer stations. The city has awarded a contract to Industrial Tank Co. to build and operate a transfer station located adjacent to its sewage treatment plant in Alviso.

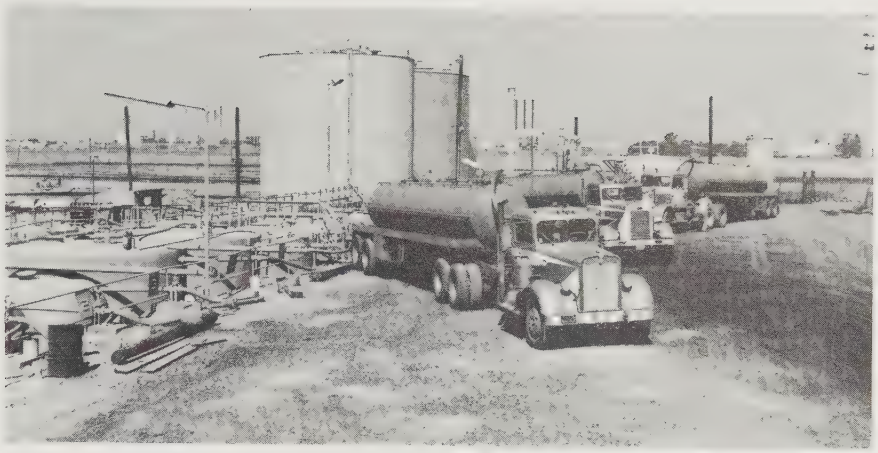
One more liquid transfer station located in San Francisco County would serve the Bay Area. Properly coordinated, these stations could serve the Bay Area's needs and relieve the sewerage systems from indiscriminate dumping while saving transporation costs.

COMMON DISPOSAL PRACTICES FOR HAZARDOUS WASTES

Mixing With Soil	Mechanically mixing wastes with soil to use the soil's natural abilities to absorb and biologically degrade it. Wastes are applied to the soil by flooding, spraying, trenching, or shallow ponding.
Evaporation	Reducing volume by evaporating or releasing volative organic components. Waste is applied by spreading or ponding.
Infiltration	Ponding hazardous wastes so that they can percolate to use the storage capacity of non-saturated underlying sediments. Infiltration rates are related to soil permeability and waste type.
Sanitary landfill	Dumping or ponding liquids beneath the surface of landfills to use the absorptive capacity of disposed refuse.
Processing	Liquids are neutralized and oil emulsions broken.Hydrocarbon vapors formed in a closed vent system are incinerated. Heavy metals are precipitated. Liquid is pumped to evaporation ponds.

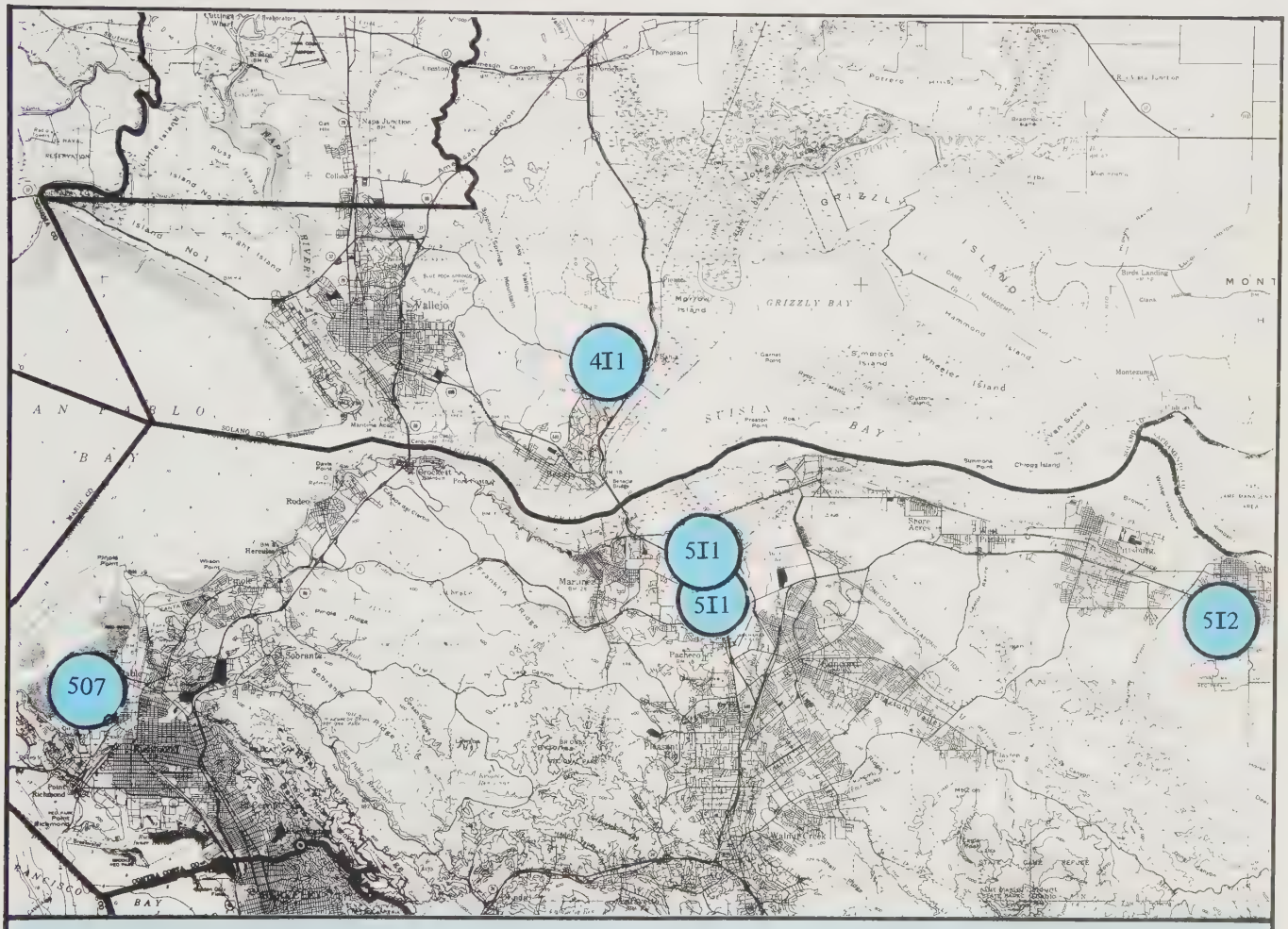
*Class I, II, III waste disposal site definitions are described in the Section, Sanitary Landfill Design and Operation. P. 114

LIQUID WASTE TRUCK UNLOADING FOR PROCESSING IN CONTRA COSTA COUNTY



Industrial Tank Photo

Bay Area Class I Disposal Sites



	SITE NAME	ACRES	METHOD OF DISPOSAL
4I1	J & J DISPOSAL SITE	242	PONDING & SOIL MIXING
5I1	INDUSTRIAL TANK	20	PROCESSING WITH INCINERATION
5I1	INDUSTRIAL TANK	130	EVAPORATION OF PROCESSED LIQUID
5I2	INDUSTRIAL TANK	66	PONDING, EVAPORATION & SOIL MIXING
507	WEST CONTRA COSTA DUMP	890	PONDING FOR EVAPORATION

Source: EASLEY & BRASSY CORP.

LIQUID WASTE DISPOSAL SITES IN THE BAY AREA

J & J DISPOSAL SITE (4I1)

The J & J Disposal Site is 242 acres of rolling hills and gully-canyons surrounded mostly by undeveloped land. It is located on Lake Herman Road in Solano County and receives 1,000 - 3,000 barrels per day of liquid wastes principally from the petroleum industry in Solano and Contra Costa Counties. The site was opened in 1969 and has a lease to 1989 with several five-year options on the property. The use of the completed site has not yet been determined nor has a replacement site been considered.

J & J Disposal is open to private collectors only from 8 a.m. to 4:30 p.m. daily except when it is closed on Saturday and Sunday. A fee of 60¢ to $1.00 and up for one barrel is charged. The site has received waste discharge requirements from the Regional Water Quality Control Board 2.

Inspection agencies are the Solano County Department of Public Health, Planning Commission, and Mosquito Abatement District; the California Department of Fish and Game, State Water Resources Board; Regional Quality Control Board; San Francisco Bay Area Air Pollution Control Board; the State Division of Industrial Safety; and the United States Environmental Protection Agency.

WEST CONTRA COSTA COUNTY DUMP (507)

The West Contra Costa County Dump is located near the west end of Garden Tract Road on Parr Boulevard on tide lots surrounded by predominately industrial areas. Of the 890 acres owned by private scavengers, only 350 acres are affected by filling operations. The site opened in 1957 and is expected to continue in operation until 1986. Conceptual plans for the final use of this site are for regional recreation. A replacement site has not yet been considered.

The site received waste discharge requirements from the Regional Water Quality Control Board No. 2 and is classified as Class I. It accepts liquid industrial from several waste haulers and several industries in the San Francisco Bay area. Users haul their own liquid waste as the company has no trucks of its own for this purpose.

On the same site about 800 tons of solid waste from west Contra Costa and Marin Counties are accepted six days a week.

The principal agencies responsible for inspection are the Contra Costa County Public Health Department, Cities of Richmond and San Pablo, Bay Conservation and Development Commission, U.S. Army Corps of Engineers, Regional Water Quality Control Board, and the Bay Area Air Pollution Control District.

INDUSTRIAL TANK, INC. (511) (two sites)

This site in the vicinity of Highway 680 and State Route 4 in Contra Costa County is operated by Industrial Tank, Inc. of Martinez. Industrial wastes from the Bay Area and Sacramento-Stockton area are hauled by Industrial Tank, Inc. on a contract basis. Accepted materials include the standard range of spent industrial liquids, sludges, and slurries. The site is open on a limited basis to other waste haulers. Liquids are processed on a 20-acre site. First they are neutralized. Then the oil emulsions are broken up to eliminate petroleum fractions. The hydrocarbons are driven off through a steam heat process and the vapors scrubbed and incinerated. Finally, solids and heavy metals are precipitated.

The remaining liquid is pumped to an adjacent 130-acre site of evaporation ponds with an 82-million gallon evaporative capacity. This site has a separate Class 1 permit issued by the Regional Water Quality Control Board.

An additional 2-million gallon storage capacity is leased in a nearby refinery and deballast (slops) from petroleum and tankers are stored in these tanks for processing.

Agencies responsible for inspection are Contra Costa County Public Health Department, Bay Area Air Pollution Control District, and Regional Water Quality Control Board.

INDUSTRIAL TANK INC. PITTSBURG FACILITY (512)

This 66-acre site is located three miles southeast of Pittsburg on Paso Corte Road adjacent to the Pittsburg Dump. As a privately owned site, it is leased to its current operators, Industrial Tank Company of Martinez, and used primarily for disposing industrial wastes.

Central Valley Regional Water Quality Control Board has given the site a Class 1 rating. Part of the requirements set by the Board for this site specify a monitoring system to assure that none of the liquid waste deposited at the site seep toward or near the Contra Costa Canal 500 yards north of the site. This Canal is part of the Mokelumne Aqueduct operated by East Bay Municipal Utility District bringing water from the Sierras.

Wastes from industrial firms in the San Francisco Bay and Sacramento-Stockton areas are hauled under contract by the Industrial Tank Company. The site is open on a limited basis to other waste haulers. It accepts the standard range of spent industrial liquids, sludges and slurries, and limited quantities of solid waste which are treated by evaporation, applied to percolation ponds on the premises, or disposed in a small landfill. Recoverable oils are processed at the firm's processing facility at Vine Hill near Martinez.

Recent Proposals

Several proposals have been recently made to handle Bay area waste. Three of these are discussed in the Planning Area Section: The Potrero Hills Regional Sanitary Landfill proposal is contained in the Napa-Solano Planning Area, the Kaiser-Radum Pits Proposal in the Alameda Planning Area, and the Alviso Report in the Metropolitan San Jose Planning Area.

A fourth proposal, A Solid Waste Management Plan for the Bay Region (Bay Delta Plan) would affect the entire nine-county Bay Area. It was undertaken late in 1970 by the San Francisco Planning and Urban Renewal Association (SPUR) through a grant from the Ford Foundation.

In summary, according to report, the plan would build as many as 16 processing/transfer stations in the Bay Region where wastes would be processed and separated into various components. Directly reusable materials such as returnable bottles and uncontaminated papers would be removed and tin cans magnetically extracted. What remains from processing would be shredded and separated into inert and organic components with the inert materials—such as glass, aluminum, rocks—separated for reuse. The organic residue would be shipped by barge to agricultural islands lying below sea level in the Sacramento-San Joaquin Delta. There it would be composted, mixed with local peat soil, and used to raise the level of these islands. Although these islands include a half a million acres of the richest agricultural soils in the world, they are sinking below sea level at the rate of two to three inches per year. Continued subsidence would virtually assure the inundation of these valuable agricultural lands.

The proposed plan would save the islands while providing a disposal area for the Bay Area's wastes for the next 100 years. The report concludes that a regional approach to waste management is needed because fragmented jurisdictions are not capable of adequately handling the situation.

Using the Delta Islands for disposal grounds would appear to have merit. But a careful scrutiny of the assumptions and conclusions of the SPUR report raises questions concerning economic soundness and environmental protection.

Consultants to the Bay Delta Plan estimate that a full-scale operation will cost about $100 million per year. This effectively doubles the present cost of the entire solid waste process in the Bay Area.

Promoters of the SPUR Plan advocate a full-scale pilot demonstration project to test and evaluate each of the scheme's operations including, transfer, processing, resource recovery, and composting, However, there is no question concerning the reliability of waste transfer and transportation systems either by truck or barge. Duplicating these proven systems in a demonstration project is not necessary. In the same way, waste processing and resource recovery are already standard procedures in many parts of the country, including San Francisco.

Before filling Delta islands with waste it is important to know what effect composting has on the leachate characteristics of refuse. Apparently composting will change certain constituents in the waste. But the key question is whether it can reduce them enough to prevent pollution of the Delta waters. And extensive research is required to determine the effects of compost on soil crops.

SACRAMENTO — SAN JOAQUIN DELTA

SPUR Photo

PLANNING AREAS

To plan for regional waste management until the Year 2010, 14 planning areas were designated. These areas were defined in several ways—by geographical features, franchise boundaries, and county lines. On the basis of current population and waste generation rates, estimates of future waste disposal sites have been made for each planning area. Landfill sites now in operation are described and alternate sites are designated when the present sites close. Related facilities, transfer stations and resource recovery facilities, are designated wherever they will be needed during the planning period. The 14 planning areas are listed and shown below and described in detail on the succeeding pages.

PLANNING AREAS

1. West Marin
2. East Marin
3. Sonoma North Coastal
4. Central Sonoma
5. Northeast Sonoma
6. Napa Valley
7. Napa-Solano
8. East Solano
9. Central/East Contra Costa
10. West Contra Costa
11. Alameda
12. Metropolitan San Jose
13. South Santa Clara
14. San Franicisco and Peninsula

Source: EASLEY & BRASSY CORP.

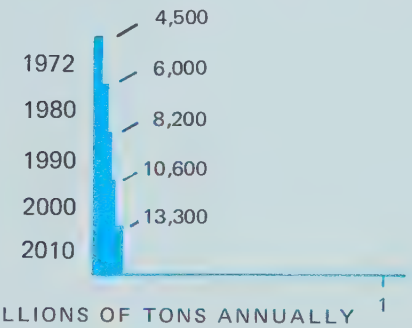
West Marin Planning Area

UNINCORPORATED TOWNS	LANDFILL SITE USED
Stinson Beach	105
Bolinas	105
Point Reyes	105
Point Reyes Station	105
Tomales	105
Dillon Beach	105
State Parks	105

West Marin Planning Area

The West Marin Planning Area is nestled between rugged hills to the east and the Pacific Ocean to the west. Its shoreline is dotted with numerous coves and bays with Tomales Bay, Bolinas Lagoon, and Drakes Bay the most prominent. What little development that has occurred in this planning area consists mostly of a few residences at Stinson Beach, Point Reyes Station, and Bolinas. Summer and weekend homes are popular throughout the area and new development is taking place at Bodega Bay to the north. Although the current permanent population in the planning area is only about 9000, it often doubles during weekends and summer months. But the many acres of national and state parklands will continue to restrict urbanization.

Projected Waste Production
WEST MARIN PLANNING AREA



Assuming 1% annual increase in base per capita waste production factor

PLANNING AREA DISPOSAL SITES

WEST MARIN SANITARY LANDFILL (105)

This 50-acre canyon landfill on Martinelli Ranch five miles north of Point Reyes-Petaluma Road opened in 1965. Operated by the West Marin Sanitary Landfill Company, it serves a permanent population of 9000 from the communities of Tam Valley, Muir and Stinson Beaches, Bolinas, and other coastal and inland areas which are mostly undeveloped. During weekends and summer months the population can often double. A May 20, 1972 report estimated the capacity at 837,500 cubic yards, (450,000 tons). At present and projected fill rates the site is expected to last beyond 2010. Its ultimate use has not been determined.

West Marin Sanitary Landfill is open from 10 am to 4:30 pm Wednesday through Sunday and is available to both private collectors and the general public. There is a 50¢ minimum load charge and other various charges depending on the content of the load.

About 85 tons are disposed each week. These are compacted and spread with a crawler tractor and covered every 48 hours. Materials reclaimed from controlled salvaging are stored on the site.

Agencies responsible for inspection of the site include the Marin County Health Department, Division of Environmental Control; the Marin County Fire Department; State Division of Forestry; and the Regional Water Quality Control Board.

WASTE MANAGEMENT

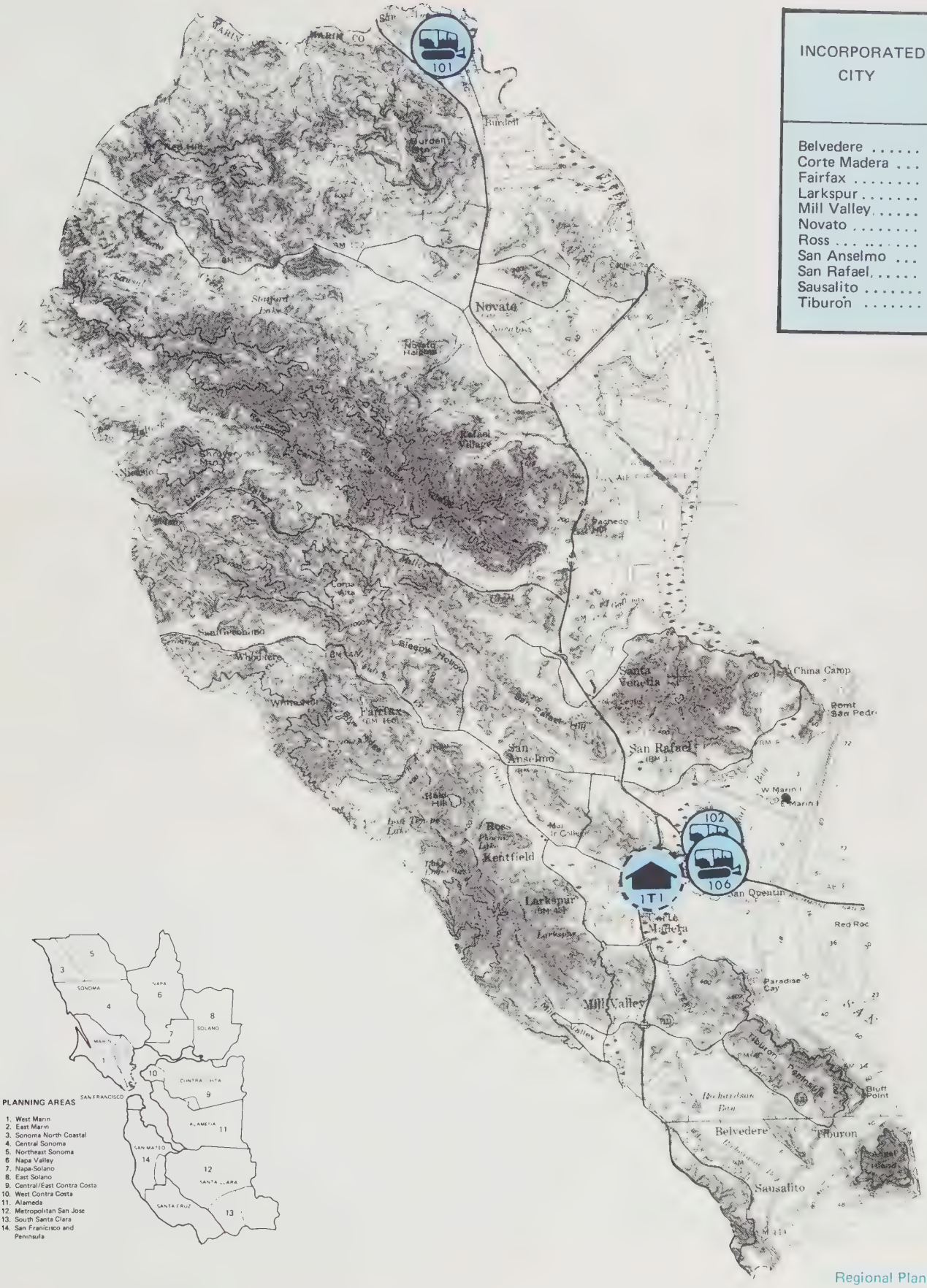
In 1972 about 4500 tons of waste produced in the planning area were all disposed in the West Marin Sanitary Landfill (105) just north of Point Reyes Station. Estimates show waste production increasing to 13,300 tons in 2010 but with population growth restricted by open space land preserves, the West Marin Sanitary Landfill is expected to be adequate for this period.

PAST [1] AND PROJECTED[2] POPULATION GROWTH
WEST MARIN PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Planning Area	N.A.	N.A.	9000	11,158	13,859	16,560	19,260

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

East Marin Planning Area



INCORPORATED CITY	LANDFILL NOW USED
Belvedere	507
Corte Madera	507
Fairfax	101
Larkspur	101
Mill Valley	507
Novato	101
Ross	101
San Anselmo	101
San Rafael	101
Sausalito	507
Tiburon	507

PLANNING AREAS

1. West Marin
2. East Marin
3. Sonoma North Coastal
4. Central Sonoma
5. Northeast Sonoma
6. Napa Valley
7. Napa-Solano
8. East Solano
9. Central/East Contra Costa
10. West Contra Costa
11. Alameda
12. Metropolitan San Jose
13. South Santa Clara
14. San Francisco and Peninsula

East Marin Planning Area

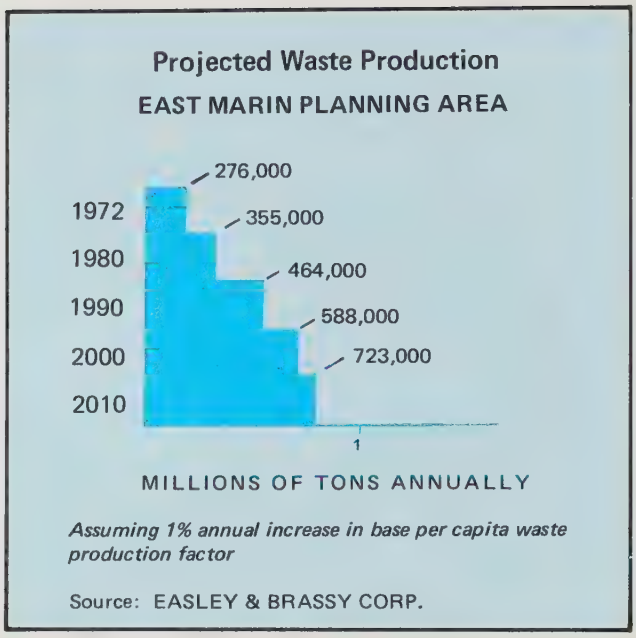
As the most populous part of Marin County, the East Marin Planning Area lies directly north of San Francisco. It is bordered on the east by San Pablo Bay and rugged terrain to the west. The natural setting of deep wooded valleys, sparkling bays and coves, and rolling hills, combined with a mild climate have drawn an ever-increasing population to enjoy relaxed living where year-round temperatures average btween 47 to 71 degrees. Between 1950 and 1970 growth and urbanization soared from a population of less than 85,000 to over 200,000. Most of this growth has channeled along Highway 101, the commuter and tourist corridor for the Golden Gate Bridge and San Francisco to the south.

WASTE MANAGEMENT

In 1972 the planning area population produced 277,000 tons of solid waste. A third, or 92,000 tons, is exported annually from Marin County over the Richmond Bridge to the West Contra Costa County Sanitary Landfill (507). The remaining waste is disposed in the Redwood Sanitary Landfill (101) and San Quentin Landfill (102). A small amount of demolition debris goes to the Ghilotti Site (106).

FUTURE WASTE MANAGEMENT

As the population increases waste generation will also increase from 277,000 tons in 1972 to 723,000 tons in 2010. These projections are low, based on current attitudes of Marin County residents to curb population growth. These attitudes are reflected in zoning restrictions, open space purchases, and, most significantly, a recent Water Board action which has placed a moratorium on building.



On the basis of the population and waste projections, it is expected that the West Contra Costa Landfill (507) will last until about 2020. However before then, because of contract conditions, the Ross Valley and Richardson Bay areas will need a transfer station (ITI) located between San Rafael and Corte Madera with haul to the Redwood Sanitary Landfill (101). With the increased loadings, the Redwood site will be filled by the Year 2001. Reserve capacity between 2001 and 2010 will require disposal capacity for approximately 6.1 million tons of waste. This could be accomplished by adding another lift at the Redwood site or by purchasing an additional site with sufficient capacity.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
EAST MARIN PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Belvedere	800	2,148	2,599	2,925	3,363	3,800	4,238
Corte Madera	1,933	5,962	8,464	10,626	12,134	13,641	14,998
Fairfax	4,078	5,813	7,661	8,319	9,089	9,859	10,630
Larkspur	2,905	5,710	10,487	11,299	12,537	14,922	17,210
Mill Valley	7,331	10,411	12,942	13,798	15,863	17,928	19,993
Novato		17,881	31,006	36,511	47,151	57,741	68,431
Ross	2,179	2,551	2,742	3,080	3,517	3,954	4,319
San Anselmo	9,188	11,584	13,031	13.393	14.633	15,873	17,237
San Rafael	13,848	20,460	38,977	43,112	48,886	54,660	60,434
Sausalito	4,828	5,331	6,158	6,969	7,938	9,090	10,137
Tiburon	–	–	6,209	6,787	7,803	8,819	9,834
Unincorporated	N.A.	N.A.	63,000	85,305	102,066	118,825	135,585
TOTAL	–	–	**203,276**	**242,124**	**284,980**	**329,112**	**373,046**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

PLANNING AREA DISPOSAL SITES

REDWOOD SANITARY LANDFILL (101)

This 600-acre landfill, owned and operated by the Redwood Sanitary Landfill, is located in Marin County on Highway 101 four miles north of Novato. The site is mostly level pasture land near Petaluma Creek surrounded by agricultural land. It began operating in 1958 and is expected to last through the Year 2000. It serves the Cities of San Rafael, San Anselmo, Ross, Novato, Fairfax, Larkspur, and the unincorporated areas with a combined population near 120,000. The site has 520 remaining useable acres or 13,000 acre-feet (10.5 million tons) capacity for filling with refuse to a 25-foot depth. An additional 10-foot lift would provide 6000 acre-feet (6.0 million tons) more capacity.

Approximately 120,000 tons of waste per year are disposed on the site. For the most part, Group 2 wastes are received with the exception of dead animals, food processing wastes, infectious material, and chemical toilet pumpings. The waste is spread and compacted with both a crawler tractor and steel wheel compactor resulting in moderate densities.

Wastes are received daily from 8 am to 4:30 pm from the general public and franchised collectors. A fee of 75¢ per minimum load and 75¢ per cubic yard is charged. Some salvage work is done on the site but is controlled.

Although the site has not received waste discharge requirements from the Regional Water Quality Control Board, it does comply with the local refuse disposal standards of the Marin County Health Department. Inspection of the operation is made periodically by the County Health Department and the State Division of Forestry.

GHILOTTI (106)

The Ghilotti site is 18 acres of marsh land surrounded by undeveloped land. It is at the east end of Francisco Boulevard north of Highway 17 and east of the San Quentin disposal site in San Rafael. It accomodates demolition debris of Marin County — about 15 tons per day. The site opened in 1963 and is expected to remain active until about 1985 when it will probably be used for a light construction site. A replacement site is being studied.

Compaction and spreading are done with a crawler tractor and cover is applied when work is slow and cover available. No salvaging operations are permitted on the site.

The site has not yet received waste discharge requirements from the Regional Water Quality Control Board but the site is inspected by the Marin County Health Department Division of Environmental Control, and the County Fire Department.

SAN QUENTIN DISPOSAL SITE (102)

The San Quentin Disposal Company operates this disposal located at 1515 Francisco Boulevard, San Rafael. It covers 60 acres of undeveloped marsh and low land. The estimated 35 acres yet to be filled should last until 1983 when the land will be converted to commercial/industrial use.

Under Regional Water Quality Control Board Order No. 69-2, San Quentin Disposal is approved to receive Group 2 wastes. However, City Ordinance prohibits wet garbage and other putrescible matter at the site. The primary users are the public who bring an average of 300 vehicles per day. An estimated 900 tons of refuse are brought to the site weekly.

The site is open from 8 am to 5 pm daily and 9 am to 5 pm on Sundays. There is a charge of $1.00 minimum and 75¢ per cubic yard. Metal salvaged on site is hauled away regularly. Heavy compaction is done with a large steel wheel compactor.

Responsibility for inspection lies with the Regional Water Quality Control Board, Bay Area Air Pollution Control District, City of San Rafael Department of Public Works, and the Marin County Health Department and Planning Department.

Sonoma North Coastal Planning Area

PLANNING AREAS

1. West Marin
2. East Marin
3. Sonoma North Coastal
4. Centra Sonoma
5. Northeast Sonoma
6. Napa Valley
7. Napa-Solano
8. East Solano
9. Central East Contra Costa
10. West Contra Costa
11. Alameda
12. Metropolitan San Jose
13. South Santa Clara
14. San Francisco and Peninsula

Sonoma North Coastal Planning Area

The north coastal portion of Sonoma County between Salt Point State Park and the Mendocino County Line as far east as the watershed divide is the Sonoma North Coastal Planning Area. Although it does not extend as far south, it generally corresponds to Planning Area 1 designated in the preliminary Solid Waste Disposal Plan for Sonoma County prepared in 1967. Limited access on one road and distance from the Bay Area have restricted development to a base population of 1000 which increases during weekends and the summer months. But this inaccessibility is expected to continue to inhibit population growth which is estimated at only 2500 by the Year 2010.

FUTURE WASTE MANAGEMENT

On the basis of these population forecasts and corresponding waste projections, the Annapolis Site (216) now serving the area is expected to have enough capacity for at least 40 years even though it is the only site operating in the planning area since the Sea Ranch Site closed.

Projected Waste Production
SONOMA NORTH COASTAL PLANNING AREA

Assuming 1% annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

PLANNING AREA DISPOSAL SITE

ANNAPOLIS (216)

This site consists of 40 acres of canyon land serving a population of about 1000 in the unincorporated portion of northwest Sonoma County. The surrounding area is mostly undeveloped . At the rate of 3 tons a day (1000 tons a year) of Group 2 wastes, the site is expected to last at least 40 years. At that time it will be used for open space.

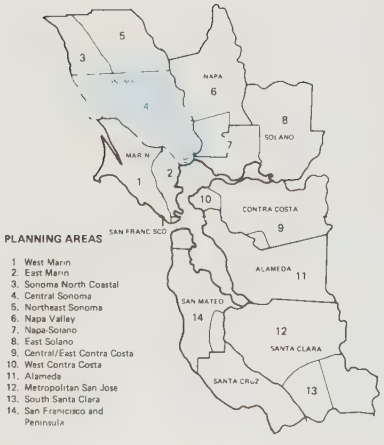
The site, operated by the Sonoma County Department of Public Works, is available to both the general public and public collectors four days a week.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
SONOMA NORTH COASTAL PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Planning Area	N.A.	N.A.	1,000	1,370	1,750	2,100	2,500

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

Central Sonoma Planning Area



PLANNING AREAS

1. West Marin
2. East Marin
3. Sonoma North Coastal
4. Central Sonoma
5. Northeast Sonoma
6. Napa Valley
7. Napa-Solano
8. East Solano
9. Central/East Contra Costa
10. West Contra Costa
11. Alameda
12. Metropolitan San Jose
13. South Santa Clara
14. San Francisco and Peninsula

CITY	LANDFILL SITE USED
Petaluma	201
Rohnert Park	217
Santa Rosa	217
Sebastopol	217
Sonoma	201
Cotati	217
Occidental	207
Guerneville	206

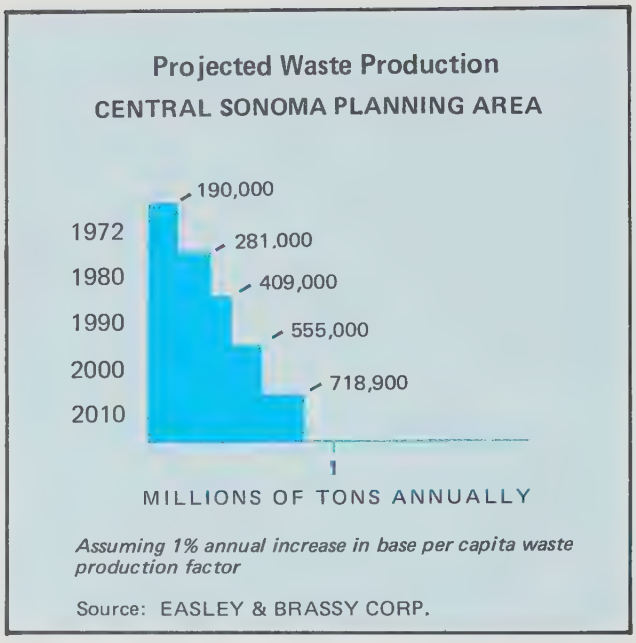

Mark West Springs
Santa Rosa
Sebastopol
Cunningham
Knowles Corner
Rohnert Park
Cotati
Stony Point
Two Rock
Petaluma
Lakeville
Kenwood
Glen Ellen
Boyes Hot Springs
Sonoma
Bennett Mtn
Taylor
Bennett Valley
Sonoma Mtn
Big Bend
Wildcat Mtn
Black Point
Midshipman Point
COTATI VALLEY
Valley of the Moon
Sonoma Valley
SONOMA MTS
217
201

Central Sonoma Planning Area

The Central Sonoma Planning Area, the most populous part of the County, is a geographically natural service area with communities serviced by four disposal sites. It lies between Napa County and the Pacific Coast and extends north as far as Salt Point. It generally comprises Planning Areas 8 through 22 as designated in the Preliminary Solid Waste Disposal Plan for Sonoma County prepared in 1967. Rich agricultural valleys characterize the area—the Santa Rosa-Cotati Valley, the Sonoma Valley, and the Valley of the Moon. To the south, land bordering San Pablo Bay adjacent to the Petaluma River becomes marshland. In 1970 the planning area population totaled 188,634 centered near Santa Rosa, Petaluma, and Sonoma. A moderate growth is predicted with the total in the Year 2010 estimated at 560,691.

WASTE MANAGEMENT

Four waste disposal sites are now operating in the Central Sonoma Planning Area since the Roblar and Windsor Sites and Petaluma City Dump closed. The Central Site (217) serves the 120,000 residents formerly served by the Windsor Site from Santa Rosa, Rohnert Park, Sebastapol, Cotati, Petaluma, and surrounding unincorporated areas. The Occidental Site (207) serves the mountain area directly west of Santa Rosa near Meeker and Occidental with a permanent population of 2000 and a summer population which nearly doubles. Vacation homes along the Russian River are served by the Guerneville Refuse Disposal Area (206), a 90-acre canyon. Refuse from 60,000 residents in and around Sonoma and Petaluma is handled at the Sonoma Refuse Disposal Area. (201)



FUTURE WASTE MANAGEMENT

The Central Site (217) which opened in 1971 is expected to operate at least another 40 years even though it may accomodate the waste now going to Occidental Site (207) in 1974. At that time Occidental will be phased out of operation and may be converted to a transfer station for haul to Central. Guerneville Refuse Disposal Area (206) also has enough capacity to last through the planning period until 2010. Sonoma Disposal Area (201) is expected to be filled by 1975 and action is now pending on a replacement site nearby.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
CENTRAL SONOMA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Petaluma	10,315	14,035	24,870	37,799	51,299	64,799	78,299
Rohnert Park	—	—	6,133	10,749	15,479	20,209	24,939
Santa Rosa	17,901	31,027	50,006	73,852	104,769	135,686	166,602
Sebastopol	2,601	2,694	3,993	5,503	7,383	9,263	11,143
Sonoma	2,015	3,023	4,112	6,329	8,491	10,653	12,815
Cotati	—	—	1,368	1,750	2,100	2,500	2,800
Unincorporated	—	—	98,152	135,333	178,253	221,173	264,093
TOTAL	—	—	**188,634**	**271,315**	**367,774**	**464,283**	**560,691**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

PLANNING AREA DISPOSAL SITES

GUERNEVILLE REFUSE DISPOSAL AREA (206)

This 90-acre canyon site, surrounded by undeveloped wooded and forest area, is located in Sonoma County on Pocket Canyon Drive off State Highway 116 east of Guerneville. It is owned and operated by Sonoma County and serves the unincorporated area nearby. About 12,000 tons are disposed here annually and it is anticipated that the site will last at least 40 more years.

Compaction and spreading are done with a crawler tractor and the waste is covered every 72 hours. A salvage operation accumulates a large quantity of metal and iron.

The site is open to the public 7 days a week from 8 am to 5 pm without charge.

OCCIDENTAL (207)

Located on Stoetz Lane six miles northwest from Harrison Grade Road, the Occidental Site is two acres of gully-canyon terrain. It serves the surrounding unincorporated areas with a population of about 2000 which nearly doubles during the summer. The site was converted from a burning dump to a sanitary landfill in 1972. It is operated by the Sonoma County Department of Public Works and is expected to remain open until mid-1974 There is no eventual use planned for the site when it closes but a transfer station is being studied.

Occidental is open to the general public and private collectors without charge from 8 am to 5 pm daily.

No waste discharge requirements have been established for the site by the Regional Water Quality Control Board but the site accepts Group 2 wastes. Materials salvaged from controlled operations are stored on the site.

Inspection agencies for the site are the Sonoma County Departments of Health and Public Works and the Water Quality Control Board.

CENTRAL (217)

The Central Site covering 390 acres of rolling hills in a predominantly agricultural area is operated by the Sonoma County Department of Public Works. It serves a population of about 135,000 in the Cities of Santa Rosa, Rohnert Park, Sebastapol, Petaluma, and the surrounding unincorporated areas. The site opened in July 1971 and is expected to operate at least another 40 years. When completed, it will be used for recreation. No alternate site has been considered yet.

Private collectors and the general public alike can dispose here from 8 am to 4 pm daily. Fees are not charged.

About 120,000 tons a year are received at the Central site. Waste is spread and compacted with a compactor and covering, including the face, is done daily. Materials from controlled salvaged operations are stored on the site.

Waste discharge requirements have been established for the site by the Regional Water Quality Control Board and Group 2 wastes are accepted. Inspection agencies for the site are the Sonoma County Department of Health and Public Works and the Water Quality Control Board.

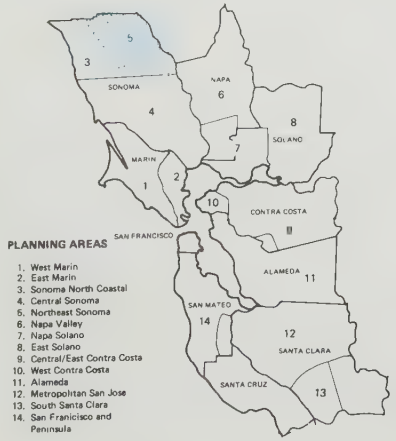
SONOMA REFUSE DISPOSAL AREA (201)

This 28-acre site of rolling hills is located on State Highway 116 between Petaluma and Sonoma. It is operated by the Sonoma County Road Department and serves a population of about 60,000 in the communities of Petaluma and Sonoma and the surrounding agricultural areas. When the site is filled by 1975 it is expected to be returned to agricultural use. Action is now pending on a replacement site nearby.

Approximately 62,000 tons a year of Group 2 wastes are received at the site from refuse collection vehicles and the general public. Compaction is done with a compactor and crawler equipment. The Sonoma Refuse Disposal Area is open seven days a week from 8 am to 5 pm and does not charge any fees.

Waste discharge requirements have not been adopted by the Regional Water Quality Control Board.

Northeast Sonoma Planning Area

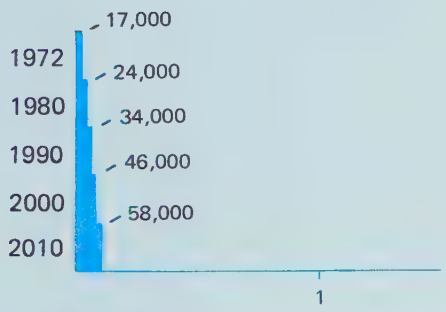


CITY	LANDFILL SITE USED
Cloverdale	204
Healdsburg	204
Unincorporated	204

Northeast Sonoma Planning Area

Located next to Mendocino and Lake Counties. the Northeast Sonoma Planning Area covers approximately the northeast quadrant of Sonoma County extending south just below Healdsburg and west as far as the watershed divide. It generally corresponds to Planning Areas 2, 3, 4, 5, 6, and 7 designated in the Preliminary Solid Waste Disposal Plan for Sonoma County of 1967. Most of the planning area is rugged terrain with the Alexander Valley surrounding the Russian River as home for about 16,000 people in the communities of Healdsburg, Cloverdale, Geyserville, Asti, and the surrounding area. Productive vineyards in the vicinity of Chianti and Asti are the economic mainstay with summer and weekend visitors also contributing to the economy. Because of the distance from the metropolitan area and the rugged terrain which is unconducive to large-scale building, population growth in the planning area is expected to be low. Projections estimate the 1970 population of 15,251 will increase to about 37,299 in the Year 2010.

Projected Waste Production
NORTHEAST SONOMA PLANNING AREA



Assuming 1% annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

WASTE MANAGEMENT

Since the Cloverdale site closed all refuse in the area is now disposed in the Healdsburg Refuse Disposal Area (204). This site has served the area since the 1930's as a burning dump before it was converted to a sanitary landfill operation in the 1960's. The site has 160 acres of remaining capacity which is expected to be adequate for well over 40 years even though the waste is estimated to increase from 17,000 in 1970 to 58,000 tons in 2010.

PLANNING AREA DISPOSAL SITE
HEALDSBURG (204)

The Healdsburg refuse disposal area covers 200 acres of hill canyon terrain on Alexander Valley Road east of Highway 101 in Sonoma County. Owned and operated by the Sonoma County Department of Public Works, the site serves a population of 16,000 in the communities of Healdsburg and Cloverdale and the surrounding areas.

At the present rate, approximately 18,000 tons of waste are disposed annually in this landfill. Although the Regional Water Quality Control Board has not adopted waste discharge requirements for the site it generally accepts only certain Group 2 wastes including garbage, rubbish, demolition and construction refuse, brush and street sweepings. Sewage residue, chemical toilet pumpings, dead animals, food processing wastes, pesticide containers or other liquids are not allowed.

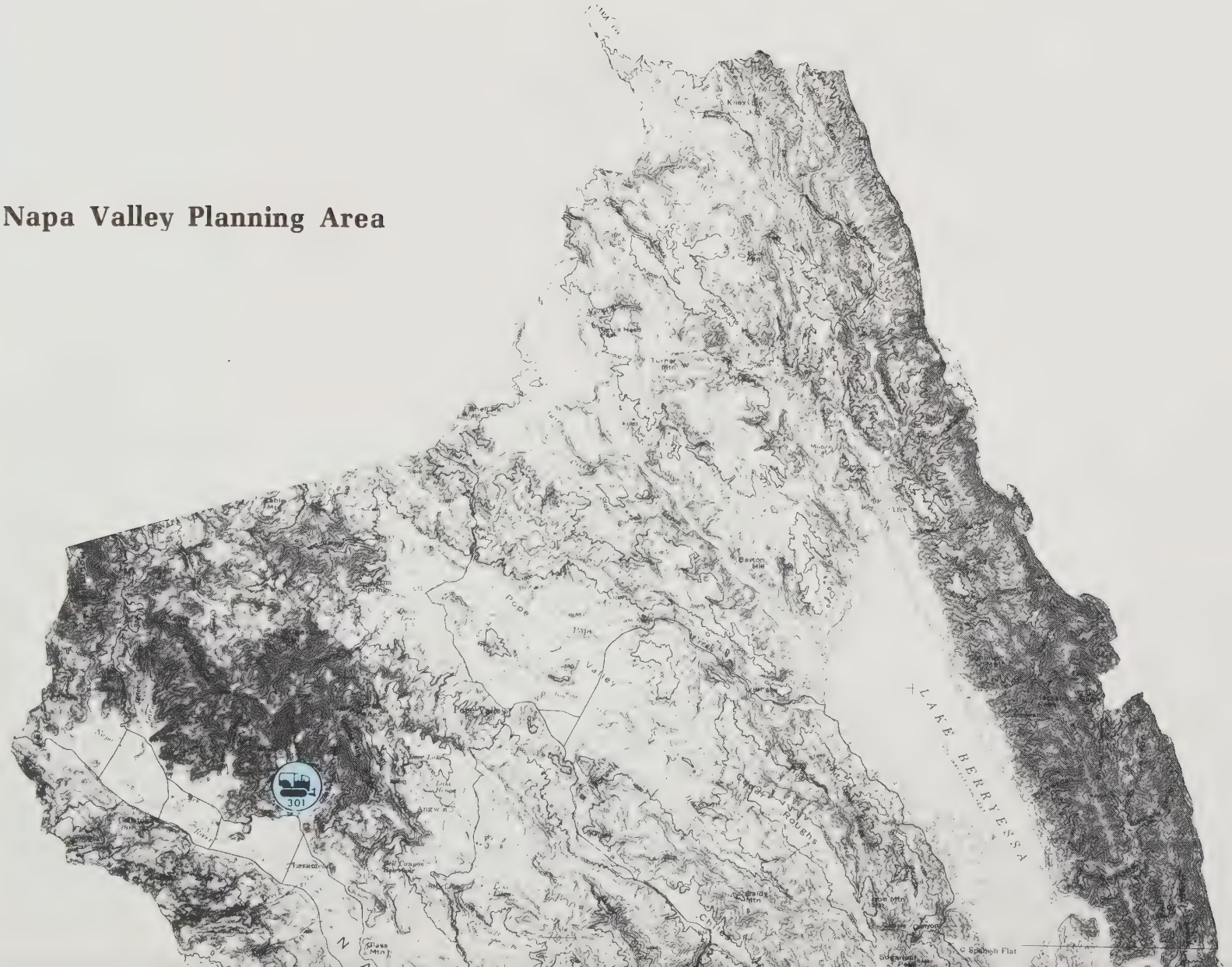
Wastes are received without fees daily from 8 am to 5 pm and are spread and compacted with crawler equipment. Covering with earth is done every 72 hours and salvaged materials are periodically removed.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
NORTHEAST SONOMA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Cloverdale	1,292	2,848	3,251	4,091	5,081	6,071	7,061
Healdsburg	3,258	4,816	5,438	7,127	9,287	11,447	13,607
Unincorporated	N.A.	N.A.	6,562	8,711	11,351	13,991	16,631
TOTAL	–	–	**15,251**	**19,929**	**25,719**	**31,509**	**37,299**

Source: 1 - U.S. CENSUS 2 - EASLEY & BRASSY CORP.

Napa Valley Planning Area



PLANNING AREAS

1. West Marin
2. East Marin
3. Sonoma North Coastal
4. Central Sonoma
5. Northeast Sonoma
6. Napa Valley
7. Napa Solano
8. East Solano
9. Central/East Contra Costa
10. West Contra Costa
11. Alameda
12. Metropolitan San Jose
13. South Santa Clara
14. San Francisco and Peninsula

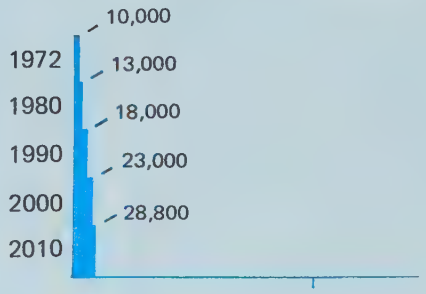
CITY	LANDFILL SITE USED
Calistoga	301
St. Helena	301
Yountville	301

Napa Valley Planning Area

The northern part of Napa County from Lake County south just below Yountville is the Napa Valley Planning Area. It also includes an irregular area south of the Lake Curry Reservoir extending to the Solano County Line. Mountain ranges and valleys running generally northwest to southeast characterize most of the area famous for its vineyards and wineries with the Napa River flowing through it to the marshlands along San Pablo Bay.

Population is centered in the Napa Valley along Route 29 and the Southern Pacific Line in Calistoga, St. Helena, and Yountville. Pacific Union College near Angwin and the U.S. Veterans Home at Yountville also contribute to the area's population. With large amounts of land in agricultural perserves restricting development, population growth can be expected to be slow. By 2010, estimates show an increase of only 11,021 over the 1970 population to give a total population of 20,894.

Projected Waste Production
NAPA VALLEY PLANNING AREA



MILLIONS OF TONS ANNUALLY

Assuming 1% annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

WASTE MANAGEMENT

Waste generation in the area was approximately 10,000 tons annually in 1972. By 2010, it is expected to increase to 28,870 tons.

With the closing of the disposal site operated by the Yountville Veteran's Home and Napa State Hospital, Upper Valley Disposal Service and Del Santi are now the only two franchises collecting in the entire planning area. Upper Valley, servicing the towns along State Highway 29 between Calistoga and Yountville and unincorporated areas, operates a canyon site at the north end of Napa Valley. This site is expected to have a capacity for at least 40 years. Del Santi, the other franchise, operates around the Lake Berryessa resort area in the eastern part of the planning area with a 10-acre site near Moskowite Corners. This site is estimated to have a 10-year future capacity. When it is filled a replacement site could be opened nearby. Alternately, a small transfer station could be built at the present site with haul to the American Canyon Sanitary Landfill located in the southeast corner of Napa County near the Napa River.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
NAPA VALLEY PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Calistoga	1,418	1,514	1,882	2,311	2,855	3,399	3,943
St. Helena	2,297	2,722	3,173	3,992	4,932	5,872	6,812
Yountville	–	–	2,332	2,888	3,568	4,249	4,929
Unincorporated	–	–	2,486	3,054	3,773	4,492	5,210
TOTAL	–	–	**9,873**	**12,245**	**15,128**	**18,012**	**20,894**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

PLANNING AREA DISPOSAL SITES

UPPER VALLEY DISPOSAL SITE (301)

The Upper Valley Disposal Site in Napa County consists of 55 acres of gully canyon at the end of Clover Flat Road off Silverado Trail. It serves the communities of Calistoga, St. Helena, Yountville, and unincorporated areas of Napa County with a combined population of about 8000. The site which receives about 140 tons a week was opened in 1963 and has capacity for more than 40 years. No plans have been made for its final use nor has a replacement site been considered.

Although waste discharge requirements have not been received from the Regional Water Quality Control Board, the site accepts only Groups 2 and 3 wastes. These are compacted and spread with a crawler tractor and covered every 72 hours. Materials salvaged from a controlled operation on the site are stored there.

Operated by the Upper Valley Disposal Service, the site is open to both private collectors and the general public from 9 am to 4 pm daily except Monday and Thursday. A 50¢ fee for a minimum load and 75¢ per cubic yard are charged.

Inspection agencies include the Bay Area Air Pollution Control District and the Napa County Health Department.

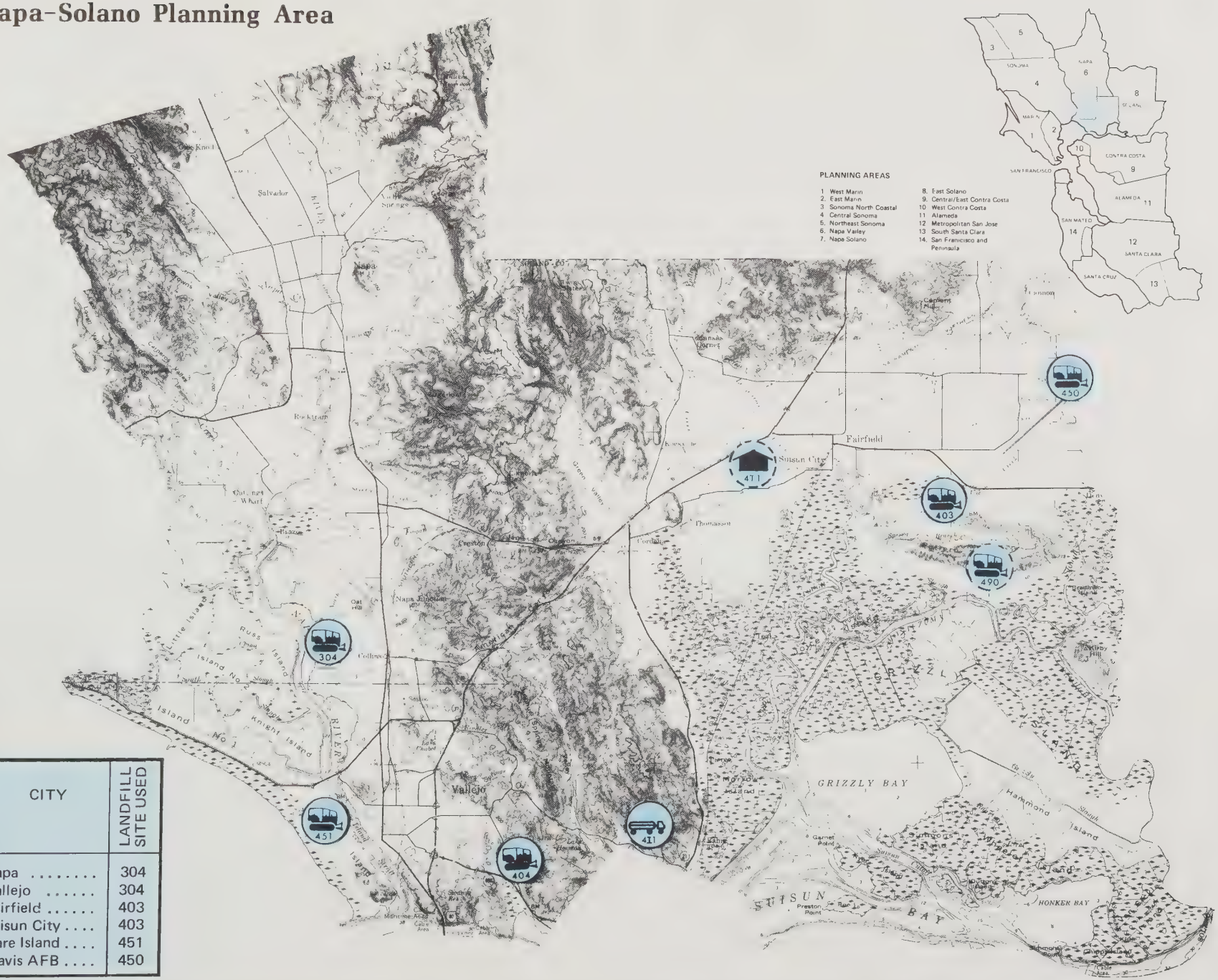
DEL SANTI (308)

The Del Santi Site in Napa County consists of 10 acres of canyon surrounded by undeveloped land. It is located one mile northeast of Moskowite Corners at Steel Canyon Road. Operations began in 1961 and about two loads a day are received from the Lake Berryessa resort area, an unincorporated portion of the county. The site is expected to remain in operation for approximately another 10 years. No use has been planned for it when it is completed and no replacement site has been considered.

Del Santi is not open to the general public but is limited to the owner-operator only. While it has not yet received waste discharge requirements from the Regional Water Quality Control Board and has no classification, it accepts mostly Group 2 wastes. These are compacted and spread with crawler tractors and brush-covered every other day. There is very little salvageable material found in the waste brought to the site.

Regular inspection is conducted by the State Division of Forestry, the Regional Water Quality Control Board, and the Napa County Health Department.

Napa-Solano Planning Area



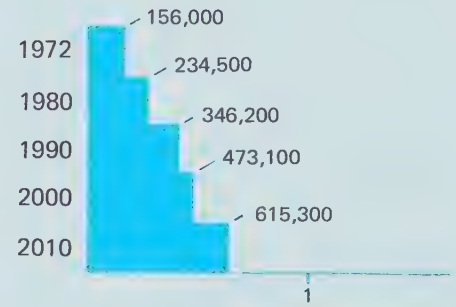
CITY	LANDFILL SITE USED
Napa	304
Vallejo	304
Fairfield	403
Suisun City	403
Mare Island	451
Travis AFB	450

Napa-Solano Planning Area

The Napa-Solano Planning Area combines Napa County south of Yountville and the southwestern part of Solano County including Potrero Hills and Travis Air Force Base. It corresponds generally to the Central and South County Planning areas designated in the Summary Report Regarding Solid Waste Management, prepared by private consultants for Solano County in 1970. The area is distinguished by marshlands around Suisun and Grizzly Bays and state game wildlife refuges and preserves.

A high growth rate is now being experienced in the Fairfield area accompanied by moderate growth in Vallejo. And more growth pressure will be felt in Southern Napa County as the agricultural vineyard preserves in the northern part of the county have been protected by a moratorium on future building. Population projections for the planning area show an increase from the 1972 population of 200,000 to 505,000 by 2010.

Projected Waste Production
NAPA-SOLANO PLANNING AREA



Assuming 1% annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

WASTE MANAGEMENT

Napa-Solano Planning area is well served by existing operations and adequate landfill. Three sites serve the general population — American Canyon Sanitary Landfill (304), Solano County Sanitary Landfill (404), and the Fairfield Disposal Site (403). In addition, the military operates two fills for its own installations, and a special-purpose landfill handles industrial wastes. Two small sites, Evers in Vallejo and Wheeler Island have closed.

The American Canyon Sanitary Landfill (304), located along the Napa River midway between Napa and Vallejo, serves both cities. It is a level, 311-acre site with a capacity of 12.2 million tons if filled to a completed average fill depth of 50 feet. This is sufficient capacity to handle planning area needs until 2008.

Southwest of Vallejo is the Solano County Sanitary Landfill (404) which serves the general public as well as the franchised collection for Crockett. Although the site has nearly 4 million tons available capacity, it is only expected to operate another four years due to the present lease agreements.

The Fairfield Disposal Site (403) southeast of Fairfield is located along Highway 12. This site is projected to last another 15 years until 1988. At that time it is likely that a transfer station will be installed with haul to the American Canyon Site (304).

Military landfill sites are operated at Travis Air Force Base (450) and Mare Island Naval Shipyard (451) but use is restricted to the military installations. Precise information was not made available during the Survey.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
NAPA-SOLANO PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Napa	13,579	22,170	35,978	48,603	65,962	83,320	100,679
Vallejo	26,038	60,877	66,733	89,634	116,796	143,958	171,120
Fairfield	3,118	14,968	44,146	66,395	96,187	125,980	144,773
Suisun City	946	2,470	2,917	3,595	4,465	5,335	6,205
Unincorporated	—	—	43,283	39,596	53,737	67,879	82,020
TOTAL	**—**	**—**	**193,057**	**247,823**	**337,147**	**426,472**	**504,797**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

A special-purpose industrial waste landfill, the J & J Disposal Site (4I1) is located just north of Benicia on Lake Hermon Road. It serves the petroleum industry in Solano and Contra Costa Counties. Because of ponding, evaporation, and the backfill method used in the operation, this site has a virtually unlimited life span.

FUTURE WASTE MANAGEMENT

Forecasts estimate a 294 percent waste generation increase rising from 156,000 tons handled in 1972 to 615,000 tons in 2010. Between 2008 and 2010 capacity for approximately one million tons of refuse must be reserved. A proposal currently being considered is for a sanitary landfill site, Potrero Hills (490). The 920 acres of rolling hills adjacent to Montezuma Slough owned by Envirosol, Inc. is being proposed by them as a regional site to serve most of the Bay Area, Sacramento, and Stockton.

Although new landfill sites can be acquired, the simplest approach would be to expand existing operations onto adjacent property. The American Canyon Sanitary Landfill, for example, controls 700 acres of land adjacent to its present site in Napa County. On the basis of 615,000 tons annually, this addition could handle waste until 2050.

As some sites close, existing sites could be used to accomodate their service areas. It is not known how long the Travis Air Force Base Site (451) or the Mare Island Shipyard Site (452) will continue to operate. But if and when operations on these sites cease, waste from these military installations can be accomodated at the Fairfield and American Canyon sites.

THE PROPOSED POTRERO HILLS REGIONAL SANITARY LANDFILL (490) SOLANO COUNTY

In Solano County near Fairfield, a 5000-acre site is proposed as a regional sanitary landfill for the Bay Area and Sacramento. At the present time the Potrero Hills basin is used for dry farming and pasture land. The sanitary landfill operation would ultimately consume 920 acres of the site accomodating 114 million cubic yards of refuse. Most of the remaining 5000 acres would continue as agricultural land. A portion would be designated for recreation and the open spaces, marshes, and sloughs would remain untouched.

Envirosol, Inc., sponsors of the project, was formed early in 1973 by three Seattle-based businessmen. The corporation holds land options previously assembled by the Boeing Company to buy 5000 acres by December 1973 for nearly $2 million.

The operation proposes barging solid waste from the Bay Area and from as far east as Sacramento and Stockton. Communities using this service would deliver wastes to a dock where it would be unloaded into a processing bin for shredding, separating, or reclamation. The degree of processing would depend on the economic value. Then a container system on barges would haul the waste to a deep water channel near the mouth of Suisun Slough. From there during high tide barges would shuttle to a dock near Grizzly Island Bridge in Montezuma Slough where they would be loaded onto trucks for the final trip along a private road to the disposal area. Direct waste haul by collection and transfer trucks from the Bay Area and Delta communities is also being planned.

Envirosol, Inc. has applied to the San Francisco Bay Regional Water Quality Control Board for a Class II disposal site permit and is seeking a conditional use permit from Solano County for the project. Soil and geologic studies already made indicate that the area is geologically suited for solid waste disposal.

No commitments have been made by cities or companies to use the site. It is anticipated that approval by various agencies will take months. During that time active negotiations for waste are expected to be made.

PLANNING AREA DISPOSAL SITES

AMERICAN CANYON(304)

The American Canyon Site, approximately 311 acres of marshy flood plain, is located in the southern part of Napa County between the Napa River and State Highway 29. It is operated by the American Canyon Sanitary Landfill Company, Inc. and serves nearly 130,000 people in Vallejo and Napa and the surrounding unincorporated areas in Solano and Napa Counties. Operations will probably continue well into the next century.

A detailed soils investigation of the site was recently completed to determine its suitability as an acceptable location to continue as a waste disposal operation. Every year, 116,000 tons of Group 2 wastes are received at the site under Order No. 68-24 of the State Regional Water Quality Control Board. The site is open seven days a week fron 8 a.m. to 5 p.m. to the general public as well as to private collectors. The fee is $1.00 per cubic yard for household garbage.

An area fill method is conducted where the waste is spread and compacted on top of the ground. Cover is applied daily except for the working face. No final plans have been developed for the property's use but when completed the site will include some recreational areas and open space.

The operation is inspected periodically by a number of agencies including the Napa County Health Department, Regional Water Quality Control Board, Bay Area Air Pollution Control District, and the State Division of Forestry.

FAIRFIELD DISPOSAL SITE (403)

The Fairfield Disposal Site, operated by Solano Garbage Company, is located 4½ miles southeast of Fairfield, south of Highway 12 at Emmington and Kildeer Roads. It consists of 70 acres of level terrain in an undeveloped area serving nearly 48,000 people from Fairfield, Suisun City, and parts of Solano County. It is anticipated that the site will operate another 16 years when it will probably be used for recreation.

No waste discharge requirements have been adopted by the Regional Water Quality Control Board but the Site receives about 75 tons of Group 2 wastes a day. These are compacted and spread with a crawler tractor and moderate compaction is achieved. Some salvaging operations are conducted and reclaimed material is stored on the site.

The site is open from 8 am to 5 pm daily except for holidays when it is closed. A minimum of $1.00 is charged and $1.00 per cubic yard.

The agencies that inspect the site are the Solano County Health Department and the Regional Water Quality Control Board.

SOLANO COUNTY SANITARY LANDFILL (404)

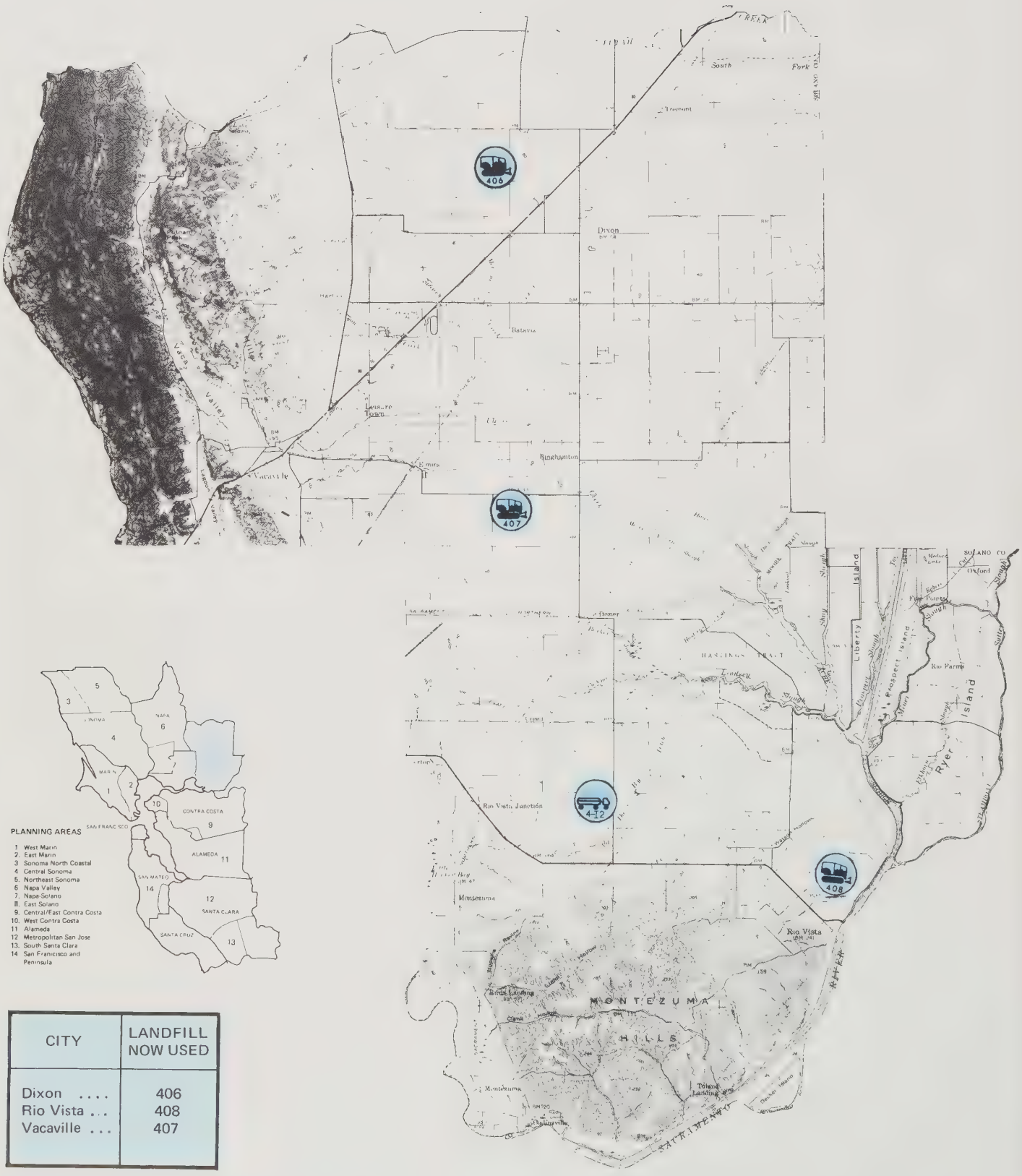
The Solano County Sanitary Landfill located at 1550 Columbus Parkway consists of 250 acres of gully-canyon and rolling hills. Surrounded primarily by undeveloped land, it receives about 15 tons of waste a day from the community of Crockett and the general public. It was opened in 1956 and is expected to remain in operation until 1977. No decision about the use of the finished site has been reached and no replacement site has been considered.

Waste discharge requirements have not been adopted yet by the Regional Water Quality Control Board. Group 2 wastes are accepted then compacted and spread with a crawler tractor and covered every 72 hours. Uncontrolled salvaging operations are permitted on site.

Solano County Sanitary Landfill is open to private collectors and the general public seven days a week from 7 am to 5 pm with a $1.00 fee for minimum loads.

Inspection agencies for the site include the Solano County Health Department, Bay Area Air Pollution Control District, and the State and County Fire Marshall.

East Solano Planning Area

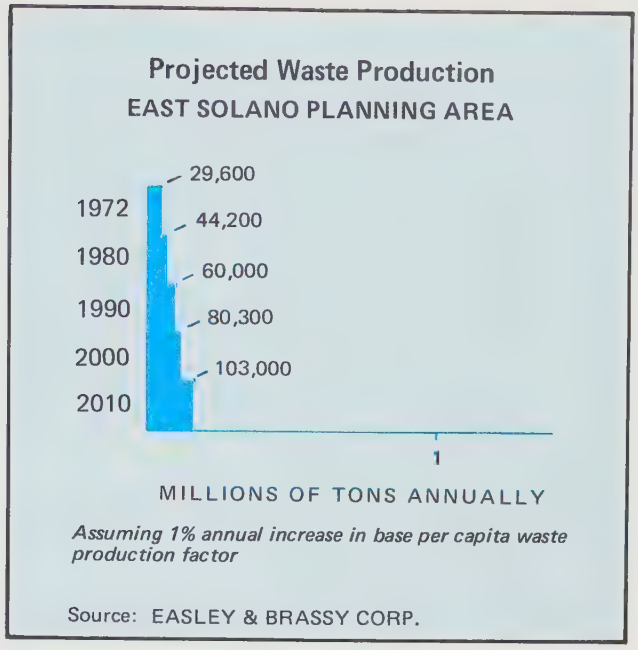


CITY	LANDFILL NOW USED
Dixon	406
Rio Vista ...	408
Vacaville ...	407

East Solano Planning Area

This planning area contains most of Solano County extending from the Vaca Valley in the west to the Solano-Yolo County Line in the north and east, and the Sacramento River — and County Line — in the south.

It generally comprises the Vacaville, Dixon, and Southeastern County Planning Areas designated in the Summary Report Regarding Solid Waste Management, prepared by consultants for Solano County in 1970. Within this area is the level Sacramento flood plain with rich agricultural land. Vacaville, Dixon, and Rio Vista are the most populated communities in the area which contained 37,577 people in 1972. A moderate growth rate is projected with a total population of 92,278 estimated for the year 2010.



WASTE MANAGEMENT

Waste generation in the area is estimated at 29,000 tons in 1972 and projected to 103,000 tons in 2010. Since the closing of the disposal grounds at the California Medical Facility, four sites accomodate refuse from this planning area. Of these four sites, one is special purpose.

The Dixon Site northwest of the community has sufficient volume for 10 years. However, because it only serves the City collection trucks and is relatively expensive to maintain, the City plans to use the B & J Drop Box Site (407) in the near future.

At the B & J Site (407) located in the center of the planning area, 160 acres are dedicated for landfill use. The site presently serves the City of Vacaville and the surrounding area with a combined population of about 25,000. This site is anticipated to last for about 32 years until 2005.

The third site, Rio Vista (408), is located north of the town of Rio Vista near the Sacramento River. This 20-acre site has been operating since 1920 and has adequate capacity for 28 more years — until 2001. At that time waste would be hauled to the B & J Drop Box Site which is expected to operate until 2005.

The special site, J & J Disposal Site II (4I2) is in the south part of the planning area and receives drillers mud from exploratory natural gas wells. It is one of the industrial disposal sites located in the northern part of the Bay Area. Because the industrial wastes accepted at this J & J site are not hazardous, the site is included in this section rather than the Hazardous Waste Section.

For the immediate future, the East Solano Planning Area has sufficient capacity in its existing sites to last at least until the Year 2005. After that a new site, possibly an extension of the B & J Site, would be necessary to accomodate approximately 600,000 tons of waste estimated to be produced between 2005 and 2010.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
EAST SOLANO PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Dixon	1,714	2,970	4,432	5,837	7,605	9,374	11,143
Rio Vista	1,831	2,616	3,135	4,064	5,295	6,527	7,759
Vacaville	3,169	10,898	21,690	28,807	37,537	46,266	54,996
Unincorporated	—	—	8,320	9,477	12,062	15,508	18,380
TOTAL	—	—	37,577	48,185	62,499	77,675	92,278

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

PLANNING AREA DISPOSAL SITES

RIO VISTA SANITARY LANDFILL (408)

Rio Vista Sanitary Landfill is located in Rio Vista, Solano County on Airport Road. The 20-acre property is owned by the U.S. Bureau of Land Reclamation and operated by the Rio Vista Sanitation Service. Since 1920 the site has served the City's 3200 population. At the present rate of disposal, 3,500 tons per year, and an average 20-foot fill depth, the site is expected to last about 28 years. Waste compaction is moderate and extreme winds in the area cause a problem of blowing papers.

While waste discharge requirements have not been adopted by the Regional Water Quality Control Board, the site accepts only Group 2 wastes from the collection company and the general public. It is open six days a week from 8 am to 5:30 pm and closed Monday. There is a minimum charge of 50¢ per load and 50¢ per cubic yard.

J&J DISPOSAL SITE II (412)

The J & J Disposal Site in Solano County on Flannery and Rio Dixon Roads is a hilly 20-acre site. It serves several private petroleum companies in the Rio Vista area and receives only waste drilling mud on the average of 1000 barrels per year. The site was selected because of its low agricultural productivity to meet the specialized disposal problems of a few companies.

J & J Disposal is open daily only to several private contractors who are charged a nominal fee. Waste discharge requirements have been received from the Central California Regional Water Quality Control Board.

Inspection agencies for the site are the Solano County Department of Public Health and County Planning Commission, the California Department of Fish and Game, State Water Resources Board, and the Regional Water Quality Control Board.

DIXON DISPOSAL SITE (406)

This site in Solano County is operated by the City of Dixon. It covers 11 acres of farmland on Sievers Road three miles west of Curry Road. It is used exclusively for city vehicles which deliver three to five loads daily from a population of 4600.

The anticipated life of the site is twelve years. At the present time no use is planned when the site is completed although a replacement site is being studied.

Wastes are spread and compacted with a crawler dozer and covered every 48 hours. Salvaging and burning are not permitted.

B&J DISPOSAL SITE (407)

This site is located in Solano County four miles east of Vacaville on Hay Road near the Rio-Dixon Highway. It serves the community of Vacaville and the surrounding areas with a combined population approaching 25,000. The total site is 160 acres of nearly level area surrounded mostly by agricultural and grazing lands. It is anticipated that the life of the site will exceed 30 years.

Approximately 25,000 tons of waste a year are disposed here. Heavy compaction is done with a crawler tractor and covering — except for the face — is done daily with material available on the site. Limited metal salvage is done but it is controlled and the material removed frequently.

At the present time there are no waste discharge requirements. However, an extensive soil investigation has been conducted for the company and submitted to the Regional Water Quality Control Board. It is expected that approval of a Class II site will be given by the Board soon.

B & J Disposal is open seven days a week from 8 am to 4:30 pm and charges $1.00 minimum and $1.00 per cubic yard.

The operation complies with current local jurisdictional disposal standards. It is inspected by the Solano County Health Department and Planning Commission, the State Division of Forestry, the local fire department, the State Vector Control, State Water Quality Control Board, Travis Air Force Base, and an occasional County Supervisor.

Central/East Contra Costa Planning Area

CITY	LANDFILL SITE USED
Antioch	502
Brentwood ..	501
Clayton	504
Concord ...	504
Lafayette ..	504
Martinez ...	504
Pittsburg ..	501
Pleasant Hill.	504
Walnut Creek	504
Crockett ...	404
Benicia	504
Rodeo	504

Central/East Contra Costa Planning Area

The Central/East Contra Costa Planning Area comprises the entire county east of the San Pablo, Pinole, and Sobrante Ridges and includes Benicia in Solano County. In general, the planning area corresonds to the Central and Eastern Study Areas designated in the Preliminary Refuse Disposal Plan, part of the Utilites Element of the Contra Costa County General Plan, 1972. However, the planning area, unlike the study areas of the Preliminary Refuse Disposal Plan, includes Rodeo and Crockett because waste from these communities, as well as from Benicia, is hauled to Acme Fill Corporation in Martinez. Mount Diablo is the dominant feature and the surrounding valley is home for nearly 300,000 Contra Costa residents. In the entire planning area, current population is 372,389. By 2010 this population is expected to increase to 755,805 reflecting a moderate growth rate.

WASTE MANAGEMENT

Waste generation for this area is estimated to be 350,000 tons in 1972. By 2010 this amount should increase to 1,350,000 annually. Five landfill sites are located within the planning area. Of these, three are general purpose sites and two are specialized industrial waste disposal.

One general purpose site, Acme Fill Corporation (504), is in the northern part of the planning area near Martinez. It is a 572-acre site with approximately 22 million tons remaining capacity serving Concord, Clayton, Lafayette, Martinez, Pleasant Hill, Walnut Creek, Danville, and Rodeo as well as Benicia in Solano County.

Antioch Dump (502), another general purpose site, is located in the northeastern portion of the planning area directly across Paso Corte Road from the Pittsburgh Disposal Site. With 16 acres of farmland it has served the community of Antioch since 1969 but has virtually exhausted its fill capacity.

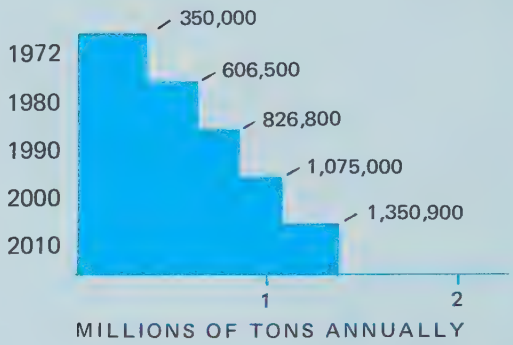
The Pittsburg Disposal Site (501), 28 acres of rolling hills, has approximately 110,000 tons remaining capacity. It now serves Pittsburg and Brentwood with a combined population of 23,000. At the current rate of use it is expected to last until 1978. However, if Antioch uses this site when the Antioch dump closes it will effectively reduce the site life by half closing it by 1976.

Both specialized industrial waste sites in the planning area are operated by Industrial Tank, Inc. The Martinez Site (5I1) is located adjacent to the Acme Fill Corporation site and uses a closed vent incineration process to treat the waste before pumping it to a 130-acre system of evaporation ponds. The Industrial Tank, Inc. Paso Corte Road facility (5I2) is a 66-acre site adjacent to the Pittsburg Disposal. It is used primarily for disposing industrial liquids by soil blending and evaporation. Both Industrial Tank sites are classified as Class I by the California Water Quality Control Board through its designated Regional Board.

FUTURE WASTE MANAGEMENT

With the Antioch Dump virtually filled and the Pittsburg Disposal Site rapidly approaching its capacity by 1976 or 1978 at the latest, the most serious problem facing the Central/East Contra Costa Planning Area is to find new disposal facilities for the areas served by these sites. Replacement facilites have recently been examined as part of the Utilites Element of the General Plan of Contra Costa County. Of the 10 sites originally selected for study, two were rejected, five considered marginally acceptable, and three considered definite possibilities. These sites — Empire, Sand Pit Site, and Ginochio — are discussed in the Preliminary Refuse Disposal Plan dated March 1972.

Projected Waste Production
CENTRAL/EAST CONTRA COSTA PLANNING AREA



Assuming 1 % annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

The Empire Site on the east side of Empire Mine Road south of Lone Tree Way is 175 acres of gently rolling terrain. Existing utility easement for a natural gas pipe would initially restrict full use of this site for compacted refuse although it might be possible to relocate the line at a later date if necessary. Sand Pit Site, two miles east of Antioch, is a 34-acre parcel used in the past as a borrow area for freeway construction. No capacity was indicated but the report noted that careful planning would be needed to gain public acceptance of this site.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
CENTRAL/EAST CONTRA COSTA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Antioch	11,051	17,305	28,060	37,238	48,522	59,807	79,091
Brentwood	1,729	2,186	2,649	5,342	7,334	8,641	9,957
Clayton	—	—	1,385	3,829	5,799	6,787	7,782
Concord	6,953	36,208	85,164	102,415	124,458	146,501	168,544
Lafayette	—	—	20,484	22,964	26,923	30,883	34,842
Martinez	8,268	9,604	16,506	18,787	22,701	26,615	30,529
Pittsburg	12,763	19,062	20,651	23,999	28,973	33,985	38,978
Pleasant Hill	—	—	24,610	28,934	34,962	40,990	47,018
Walnut Creek	2,420	9,903	39,844	45,391	56,373	67,355	78,336
Crockett	—	—	3,374	3,913	4,588	5,263	5,938
Benicia	—	—	8,783	9,477	12,349	15,221	18,093
Rodeo	—	—	5,356	6,212	7,284	8,355	9,426
Unincorporated	—	—	115,523	122,662	157,537	193,023	227,271
TOTAL	**—**	**—**	**372,389**	**431,163**	**537,803**	**643,426**	**755,805**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

The third site described in the report has once been proposed for development as a Refuse Disposal Site by private developers. The Ginochio Site (590) is a 480-acre parcel of semi-rugged terrain between one and two miles south of the Antioch dump. Although it would serve the Antioch-Pittsburgh-Brentwood area, it seems to be inaccessible as a disposal site for the western part of the planning ara when new facilites are needed there.

It appears that an alternate solution for the Pittsburg-Antioch-Brentwood area would be direct haul to the Acme Fill Corporation site (504) rather than investment in developing a new disposal site that would serve only 53,000 people producing less than 150 tons of waste a day.

The Acme site is well located within 12 miles of Pittsburg, 16 miles of Antioch and 24 miles of Brentwood within the range of direct haul.

Based on the present fill capacity of Acme Fill Corporation of 22 million tons, and assuming that within five years, or by 1978, it will be the only general purpose landfill in the planning area, it is expected that the site will be adequate until 2001. Between then and 2010 an additional 10.3 million tons of waste will be produced by the planning area and at that time additional landfill will have to be acquired.

PLANNING AREA DISPOSAL SITES

PITTSBURG DISPOSAL SITE (501)

This site in Contra Costa County is 28 acres of rolling hills surrounded by undeveloped land west of Pittsburg. It was opened in 1941 and is expected to operate another six years. No use is planned for the completed site and no replacement site has been found. About 75 tons per day are brought to the site from Pittsburg and unincorporated nearby areas with population near 23,000.

Waste discharge requirements have not been established for the Pittsburg site by the Regional Water Quality Control Board but only Group 2 and Group 3 wastes are accepted.

Wastes are spread and compacted with a crawler tractor and, except for the face, covered daily. Salvaging recovers materials which are frequently removed from the site.

It is open from 8 am to 5 pm daily and available to the general public and private collectors. There is a 50¢ charge for a minimum load or a cubic yard.

The Contra Costa County Health Department and Mosquito Abatement District inspect the site.

ANTIOCH DUMP (502)

This site covers 16 acres of rolling hills located in Antioch at the southeastern corner of Somerville Road at Paso Corte Road. It serves Antioch and part of Contra Costa County with a population of about 30,000. The site, opened in 1969, is expected to close within a year although its ultimate use has not yet been determined. A replacement site, however, has been acquired.

Although the Regional Water Quality Control Board has not yet established waste discharge requirements, the site accepts about 80 tons a day of Groups 2 and 3 wastes. It is open from 8 am to 5:30 pm daily, available to the public and private collectors. There is a minimum charge of 25¢ plus 40¢ per cubic yard.

Wastes are spread and compacted with a crawler tractor. Covering, on a daily basis, includes the face. Materials salvaged on the site are removed frequently.

The Contra Costa County Health Department and Mosquito Abatement District inspect the site.

ACME FILL CORPORATION (504)

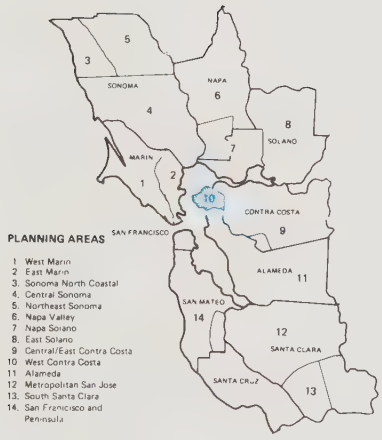
Acme Fill Corporation is a 572-acre site of rolling hills surrounded by residential, agricultural, industrial, and undeveloped land. It is located in Contra Costa County at the end of Arthur Road in Vine Hill. About 700 tons of waste a day are brought here from approximately 300,000 people in the Cities of Benicia, Orinda, Moraga, Lafayette, Martinez, Pleasant Hill, Rodeo, Concord, Clayton, Danville, and Alamo. The site is calculated to last until the Year 2001 when the land has been conceptually planned for recreation, agriculture and light construction. Adjacent property could be considered for a replacement site.

Waste discharge requirements have not been issued by the Regional Water Quality Control Board but the site accepts mostly Group 2 wastes. These are compacted and spread with a crawler tractor and, except for the face, covered daily. Controlled salvaging is permitted and collected materials are frequently removed from the site.

Acme Fill Corporation is open 24 hours a day seven days a week to public and private collectors and from 7 am to 5 pm to the general public. There is a charge of $1.25 for a minimum load and a charge of 75¢ per cubic yard.

The Contra Costa County Health Department and Mosquito Abatement District inspect the site.

West Contra Costa Planning Area



West Contra Costa Planning Area

Richmond, San Pablo, El Cerrito, Pinole, and Hercules fall within the West Contra Costa Planning Area which extends north from Alameda County to San Pablo Bay and as far east as the San Pablo, Sobrante, and Pinole Ridges. Although it excludes Rodeo and Crockett, it otherwise corresponds to the Western Study Area designated in the Preliminary Refuse Disposal Plan, part of the Utilities Element of the Contra Costa County General Plan, 1972. Development has taken place on the alluvial plane below the ridges and approximately 195,000 people are living in the planning area at this time. A low growth rate forecast estimates about 371,000 people in the area by 2010.

WASTE MANAGEMENT

The West Contra Costa County Dump (507) a 890-acre site, serves the entire planning area and also Sausalito and Mill Valley in Marin County. This site received about 800 tons daily. During the late 1960's the site was a major demolition site for Richmond Urban Renewal Program and received as much as 2,000 tons a day of debris.

FUTURE WASTE MANAGEMENT

At the present fill rate, accounting for increased population and waste production, the West Contra Costa County Dump is expected to last until 2020.

PLANNING AREA DISPOSAL SITE

WEST CONTRA COSTA COUNTY DUMP (507)

The West Contra Costa County Dump is located near the west end of Garden Tract Road on Parr Boulevard on tide lots surrounded by predominately industrial areas. Of the 890 acres owned by private scavengers, only 350 acres are affected by filling operations. The site opened in 1957 and is expected to continue in operation until 2020 with a planced final fill depth of approximately 65 feet. Conceptual plans for the final use of this site are for regional recreation. A replacement site has not yet been considered.

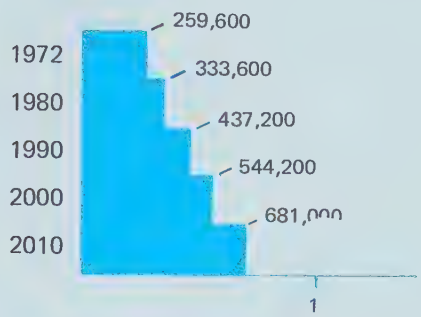
The dump serves a combined population of about 208,000 from the Contra Costa County Cities of Richmond, San Pablo, Pinole, and El Cerrito, the town of Hercules, the San Pablo Sanitary District, and the Cities of Sausalito and Mill Valley. Certain dry refuse is hauled from the light industrial area in Berkeley.

It is open to the general public including public and private collectors from 8 am to 4:30 pm seven days a week except when it is closed on Christmas, New Years, and Thanksgiving. There is a 15¢ charge per disposal can and a 50¢ charge per cubic yard.

About 800 tons of waste are received here during the week and less than this amount on week-ends. Crawler tractors compact and spread the material which is covered daily. Salvage is conducted on the site.

The site has received waste discharge requirements from the Regional Water Quality Control Board No. 2 to accept Group1 wastes. The principal agencies responsible for inspection are the Contra Costa County Public Health Department, City of Richmond, San Pablo, Bay Conservation and Development Commission, U.S. Army Corps of Engineers, Regional Water Quality Control Board, and the Bay Area Air Pollution Control District.

Projected Waste Production
WEST CONTRA COSTA PLANNING AREA



MILLIONS OF TONS ANNUALLY

Assuming 1% annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

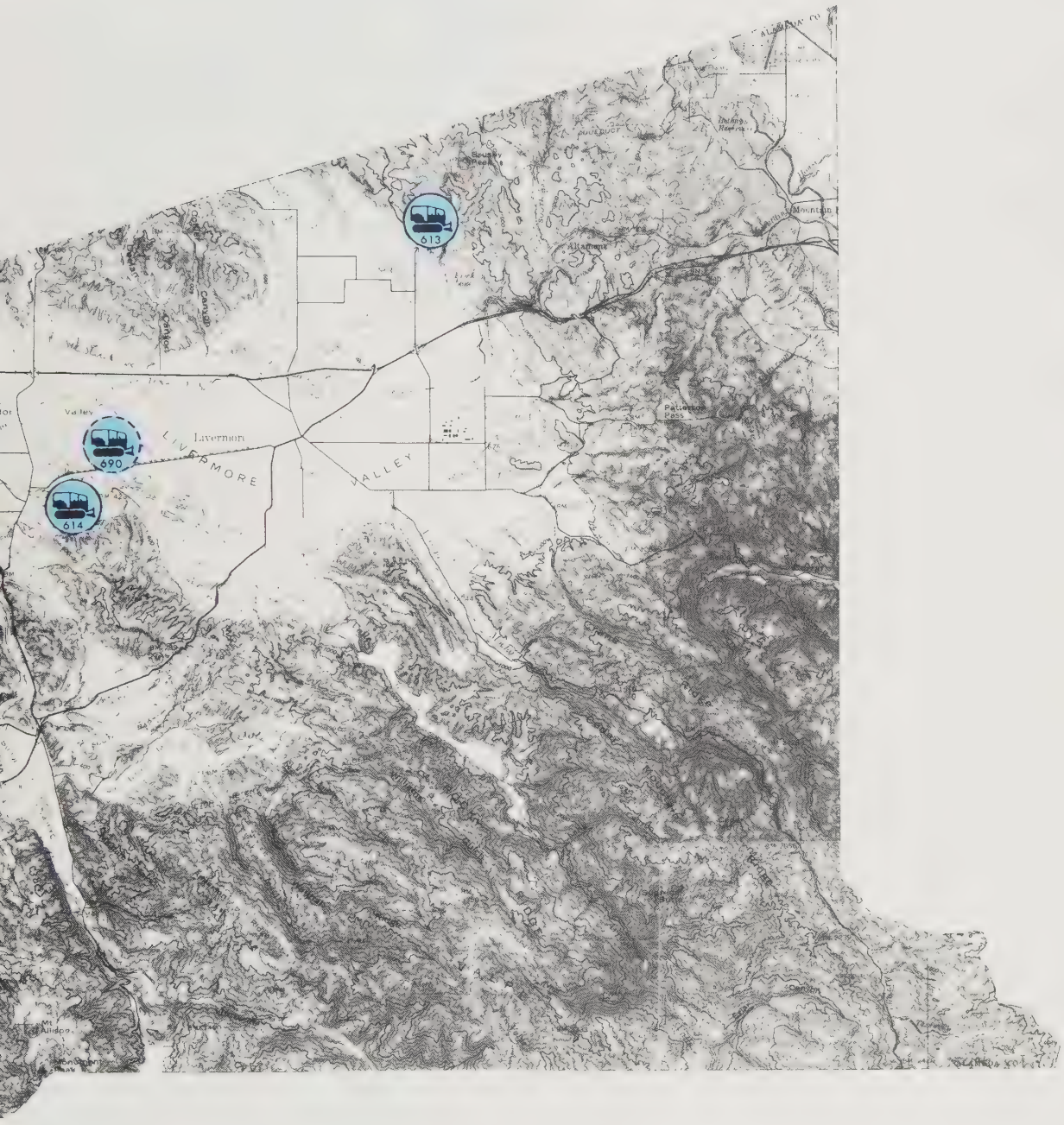
PAST[1] AND PROJECTED[2] POPULATION GROWTH
WEST CONTRA COSTA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Richmond	–	71,854	79,043	96,793	113,482	130,171	146,859
El Cerrito	18,011	25,437	25,190	27,848	31,578	35,308	39,038
Hercules	353	310	252	510	756	989	1,264
Pinole	1,147	6,064	15,850	16,784	18,882	20,980	23,078
San Pablo	14,476	19,687	21,461	24,894	29,186	33,479	37,771
Kensington	–	–	5,823	6,521	7,395	8,268	9,142
Unincorporated	–	–	47,689	61,551	78,991	96,431	113,871
TOTAL	**–**	**–**	**195,308**	**234,901**	**275,270**	**325,626**	**371,023**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

Alameda Planning Area

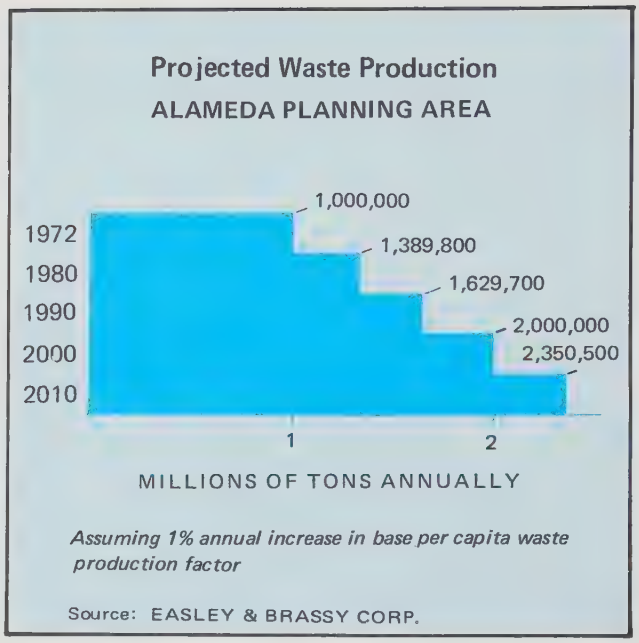
CITY	LANDFILL SITE USED
Alameda	603
Albany	604
Berkeley	602
Emeryville	604
Fremont	612
Hayward	606
Livermore	613
Newark	612
Oakland	604
Piedmont	604
Pleasanton	614
San Leandro	604
Union City	612
San Ramon	613


613
690
614
Livermore
LIVERMORE
VALLEY
Valley
Altamont
Patterson Pass

Alameda Planning Area

This planning area includes all Alameda County plus a small portion of Contra Costa County near San Ramon Village. It is marked by an alluvial plain along the eastern shore of San Francisco Bay. This plain varies in width from 3 miles in the north to 12 miles in the south and is bounded by the Berkeley and San Leandro Hills to the east. Beyond these wooded hills is an extensive system of valleys including the Livermore Valley in the eastern part of Alameda County.

The population in this planning area is heavily concentrated through Berkeley, Oakland, and San Leandro and in the smaller suburban communities of Union City and Fremont as well as the Livermore-Pleasanton area. In 1970 the population the planning area was 1,073,984 and is expected to increase to 1,649,000 by 2010. Most of this growth will occur in the suburban areas compared to a low growth anticipated for the metropolitan area.



WASTE MANAGEMENT

There are 11 general-purpose landfill sites in the planning area handling about one million tons of solid waste in 1972. Seven of these are located along the Bay front and two are on the south flood plain near Union City and Fremont. Another two sites are secluded in the foothills of the Livermore Valley.

FUTURE WASTE MANAGEMENT

Available landfill space is rapidly running out in the Oakland Metropolitan segment of the Alameda planning area. More space will have to be found soon for this segment which includes Berkeley and San Leandro. The Berkeley Site (602), which receives nearly 120,000 tons of waste annually, is expected to fill by 1977. The Alameda City Disposal Site (603) has already reached the end of its useful fill capacity although 74,000 tons of waste a year are still being disposed there. As an interim solution, plans are now being made to take City of Alameda waste to the Davis Street Site (604)

PAST[1] AND PROJECTED[2] POPULATION GROWTH
ALAMEDA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Alameda	64,430	63,855	70,968	72,105	74,218	75,275	76,067
Albany	17,590	14,804	14,674	16,431	18,632	20,832	23,033
Berkeley	113,805	111,268	116,716	117,238	121,312	125,839	130,366
Emeryville	2,889	2,686	2,681	2,727	2,833	2,939	3,044
Fremont	—	43,730	100,869	134,909	178,072	221,235	264,399
Hayward	14,272	72,700	93,058	97,406	103,863	110,320	116,777
Livermore	4,362	16,058	37,703	49,727	67,487	85,247	103,007
Newark	—	9,884	27,153	36,927	48,742	60,447	72,371
Oakland	384,575	367,548	361,561	369,957	384,296	398,636	412,975
Piedmont	10,132	11,117	10,917	11,438	11,957	12,473	12,889
Pleasanton	2,244	4,203	18,328	25,785	34,994	44,203	53,412
San Leandro	27,542	65,962	68,658	72,214	77,001	81,788	86,575
Union City	—	6,618	14,724	20,118	26,555	32,991	39,428
Unincorporated	—	—	134,276	160,094	187,995	223,016	254,416
TOTAL	—	—	1,073,984	1,187,076	1,337,957	1,495,241	1,648,828

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

already serving 450,000 people. But, at the rate of 7200 tons of waste a week, the Davis Street Site will be filled by 1977. At that time, the Oakland Scavenger Company plans to haul directly to the West Winton Site (602) if the necessary permits are granted. South of the Davis Street Site, the San Leandro Marina Site (605), now receiving 39,000 tons annually from the general public and demolition contractors, is to be completed as a golf course in 1974. It is expected that the majority of its customers will then use the Davis Street Site.

Thus, beginning in 1977, a total of 630,000 tons of waste a year will have to be transferred. Soon after that time, in 1982, the Albany landfill (601) is scheduled to be completed. This site now receives 80,000 tons of demolition and other Group 3 waste annually. It is not known how long the Alameda Naval Air Station Site (650) will continue operations as it is used exclusively by the military. If and when it closes, more waste will be added to the planning area disposal sites.

As these sites fill, the long-term solution will be a transfer station located near the center of the service area. A tentative location, (6T1) near freeway and rail transportation, would require only seven-or eight-mile drives from the most distant point in the Oakland Metropolitan part of the planning area. At the outset the transfer station would probably handle 2000 tons of waste daily and would be capable of providing a resource recovery operation in conjunction with the transfer. During that period, waste will probably be hauled 35 miles to the Eastern Alameda County Disposal Site (613) northeast of Livermore. The Kaiser Pits (690) could also serve as a disposal site but would require permits for Class II disposal.

South of the Oakland Metropolitan area, Hayward and Castro Valley are served by the West Winton Avenue Site (606) which also receives waste from the Port of San Leandro. This entire site consists of 424 acres of flood plain adjacent to San Francisco Bay. The present operation takes place on 69 acres on the north portion of the property. It is expected to be finished in 1973 and approval has already been granted for filling an additional 95 acres which will be sufficient until 1976. The remaining 320 usable acres have not received permits although they would provide the disposal space required for the nearly 230,000 people served by the site. A decision is still pending by the State Lands Commission to establish jurisdiction on the site before permits can be granted. To conserve disposal space as the site rapidly nears completion, the Oakland Scavenger Company closed it to the public early in 1973. Most of these former customers now use the San Leandro Site (605) or the Turk Island Company Site (611).

With the West Winton Avenue Site (606) expected to be completed by 1976 and without filling permitted on the remaining 320 acres, it will be necessary to build a second transfer station (6T2) for this area. Located near the intersection of Highways 92 and 17 this station would handle about 500 tons of waste a day. Because this is a relatively small amount of waste to handle, a full-scale resource recovery operation would not be economically feasible. However, a preliminary shredding and air classification could be made and the heavy fraction hauled to transfer station 6T1 for further processing. Like 6T1, the waste from station 6T2 would be hauled to the Eastern Alameda County Disposal Site.

In the eastern part of the planning area in the Livermore Valley, the Pleasanton Public Dump (614) is also nearing completion. Its owners expect to convert the site to a transfer station in 1977 and haul about 20,000 tons annually to the 297-acre Eastern Alameda County Disposal Site (613) now used by the City of Livermore and San Ramon Village. If both transfer station 6T1 and 6T2 and Pleasanton add their wastes to the Eastern Alameda Site, operations could continue until 1997 allowing for appropriate population growth. Beyond that time, property is available adjacent to the site for use until 2010.

In the southern part of the planning area near Union City, Newark, and Fremont, two sites now operate — the Turk Island Company (611) and the Fremont Site (612). Turk Island serves the general public and is expected to close in 1983 for development into a commercial-industrial park. The Fremont Site (612), opened in 1967, serves Fremont, Newark, and Union City, and the surrounding unincorporated area. This 255-acre site has a calculated capacity of 6 million tons under the present fill plan. At the present rate of filling, and allowing for population growth in the area, the site should be sufficient until the Year 2000. For the next ten years, until 2010, an additional 4 to 5 million tons of waste will be generated in this area. Since the transfer station 6T2 will already be operating near Hayward, wastes can be hauled to it from Fremont.

The Oakland Scavenger Company has recently retained a consultant to investigate solutions leading to the implementation of a long–range solid waste management program for all East Bay Cities in Alameda County.

KAISER RADUM PITS PROPOSAL (690)

The proposed sanitary landfill project would reclaim the Kaiser-Radum pits, a 775-acre sand and gravel mining operation located north of the City of Pleasanton in the unincorporated part of Alameda County. Permits for mining authorized extraction of more than 200 million cubic yards of aggregate. Normally pits are excavated to depths of 100 to 125 feet and remain as open holes scarring the face of the land.

Kaiser Sand and Gravel Company, owners and operators of the pits, proposes using solid waste to reclaim the pits using solid waste for eventual development into open-space, recreational, general industrial, professional buildings, and residential use.

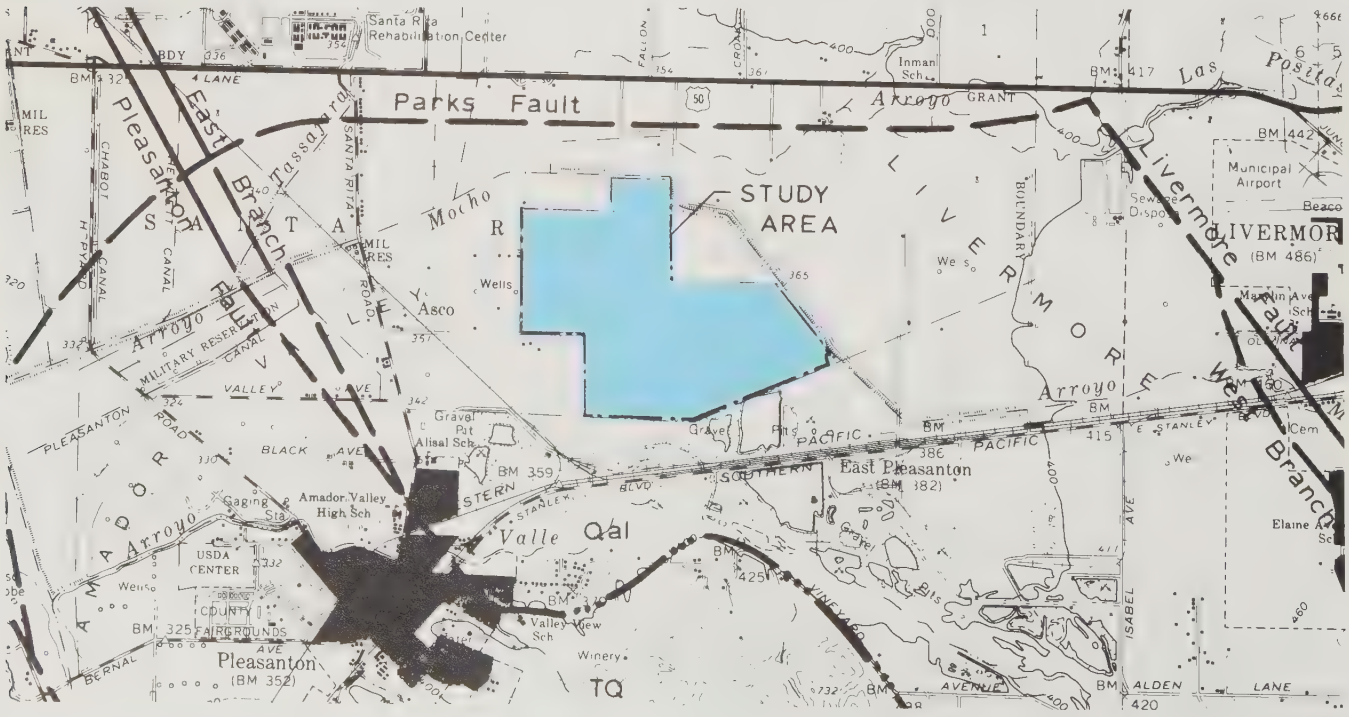
Plans call for transporting 2000 to 3500 tons a day of solid waste by truck or railroad from East Bay cities served by the Oakland Scavenger Company. Emcon Associates, consultants to Kaiser, have concluded that 45 million tons of refuse could be deposited in the pits providing over 45 years of disposal capacity for East Bay cities after the Scavenger's present sites in San Leandro and Hayward are completed in the next few years.

A sanitary landfill operation in these pits would require a number of features not common to most landfills. The major concern is the protection of the valley's underground water which supplies nearly 100,000 people. Kaiser proposes to install a 30-foot wide clay liner along the pit walls. This liner, together with the natural 20-foot thick clay barrier underlying the pit, will prevent migration of leachate or gas from the landfill. Also proposed is a system designed to collect leachate produced with the refuse fill and to withdraw it through a gallery and riser system.

Nearby faults surrounding the Radum pit area would impose special operating conditions as part of the waste discharge requirements. Most significant is the density of fill required in the operation. Fill placed in the pit must have an average in-place density of 45 pounds per cubic foot and 75 pounds per cubic foot along the perimeter of the site to assure the integrity of the perimeter slopes and barriers in case of a major earthquake.

For such a density—compared to normal landfill operations ranging between 900 and 1200 pounds per cubic yard—Kaiser has investigated alternative methods. One method would mix waste and earth cover on a three to one ratio and employ heavy compaction equipment for placement. The large quantities of overburden material available as spoil from the gravel harvesting operation make this a feasible solution. Another method would compact waste by high-pressure baling techniques. Bales produced in this way have average densities of 65 pounds per cubic foot or 1750 pounds per cubic yard.

To date the project has been rejected by the State Water Quality Control Board. The Alameda County Planning Commission has approved the project as a Class III sanitary landfill. At this time future action by Kaiser Sand and Gravel is unknown.



PLANNING AREA DISPOSAL SITES

ALBANY LANDFILL (601)

This site is owned by the City of Albany and is operated by Albany Landfill, Inc., a private company. It covers 105 acres of bay land adjacent to Golden Gate Fields. The site is being developed into a recreational and commercial marina and shopping area by the City of Albany by a plan prepared by architects and planners. The project should be completed around 1982. At this time no replacement site is being considered.

About 80,000 tons of waste a year are brought to the site which accepts only Group 3 wastes. This refuse consists mostly of demolition and construction debris, brush and stumps, appliances, tires, and rubbish. No regular household garbage is accepted. The Regional Water Quality Control Board has not yet issued waste discharge requirements.

The site is open to the general public and private haulers seven days a week between 7 am and 4:30 pm. There is a minimum charge of 25¢ with 50¢ per cubic yard charged additionally.

Wastes are placed with a compactor and covered every 72 hours with earth. There have been no fire problems and the operation is generally trouble-free.

The Regional Water Quality Control Board inspect the site periodically.

ALAMEDA CITY DISPOSAL SITE (603)

This Alameda site is located on 35 acres of flood plain adjacent to the San Leandro Bay north of Doolittle Drive. It serves a population of 74,000 from the City of Alameda. Collection vehicles and the general public deposit approximately 190 tons of waste a day.

The site began in 1953 and is expected to cease as soon as a suitable alternative is found. Some areas are now being used for recreation and when the disposal work ends the entire site will probably be available for recreation.

The Alameda City Disposal Company operates the site which is open between 8 am and 4:30 pm seven days a week. The minimum charge is 50¢ and 50¢ per cubic yard for all additional material.

Imported dirt is used to cover the site every day except for the working face which is covered weekly. During the past year there have been no fire problems. A minimum salvage effort recovers light metals which are removed frequently.

A number of agencies inspect this operation—the Alameda City Engineer's Office, Alameda County Health Department, Bay Area Air Pollution Control District, U.S. Army Corps of Engineers, Department of Agriculture, and Regional Water Quality Control Board.

BERKELEY LANDFILL (602)

This landfill, owned by the City of Berkeley and operated by the Berkeley Landfill Company, is located at the western end of University Avenue south of Golden Gate Fields at the edge of the bay. It takes in household waste from the City's population of 113,000 and also receives general rubbish and trash from Emeryville and El Cerrito and portions of Albany and Oakland. In all, approximately 415 tons a day are delivered to the site — nearly 120,000 tons per year. The site is open from 8 am to 5 pm daily. Fees are 50¢ minimum and 50¢ per cubic yard.

Forty acres will be filled for recreation and open space with an average depth of 25 feet. Where hills are planned, fill will reach as high as 60 feet. The landfill is expected to be exhausted by 1980. It appears now that a transfer operation is the most likely alternative for a replacement.

Waste material is heavily compacted but the lack of earth cover available on the site permits cover application only on a weekly basis. A limited salvage operation recovers materials which are frequently hauled from the property.

Under Resolution No. 69-13, the Regional Water Quality Control Board has designated this site as Class 2. Periodic inspection is made by the Berkeley Fire and Public Works Departments, Regional Water Quality Control Board, and the Bay Area Air Pollution Control District.

DAVIS STREET (604)

Davis Street is a 220-acre site of bay fill that was diked in 1942 and since developed. It is located in San Leandro at the foot of Davis Street and serves a population of 450,000 from the Cities of Albany, Piedmont, Emeryville, Oakland, and San Leandro. The site is owned and operated by the Oakland Scavenger Company and is being developed into a recreational area when it is completed in 1977. At that time the wastes are planned to be hauled to the West Winton site in Hayward.

In 1963 the Regional Water Quality Control Board adopted waste discharge requirements for the site. Resolution No. 464 allows Group 2 wastes to be disposed on the property. About 7200 tons a week are disposed here, compacted with crawler tractors, and covered daily except for the working face.

Davis Street is open to the public seven days a week from 8 am to 5 pm with a 50¢ minimum charge and 75¢ per cubic yard charged for large loads.

A tin can salvage operation is conducted at the landfill by the Los Angeles By-Products Company. Two mobile shredding units operate daily shredding household waste and magnetically sorting tin cans. Every day about 40 tons of tin cans are salvaged and trucked to Sacramento for processing before being shipped to Utah for use in the copper mining industry.

The agencies responsible for inspection include the Alameda County Health Department, The Regional Water Quality Control Board and the Bay Area Air Pollution Control Board.

MARINA DISPOSAL (605)

The Marina Disposal Site is operated by Turk Island Company, the firm that also operates the landfill site in Union City. The land is owned by the City of San Leandro and is being developed into a golf course and recreational area. It is located at Neptune and Fairway Drive south of the San Leandro Marina. It covers 135 acres of level land adjacent to San Francisco Bay surrounded by commercial and residential development.

The site has been classified as Class II by the Regional Water Quality Control Board. However, the majority of waste received here is actually Group 3 material from the general public and demolition contractors. On the basis of 39,000 tons of waste received annually from San Lorenzo, San Leandro, Oakland, Castro Valley, and Alameda County, the site is expected to last until 1975 although no consideration has been given to a replacement site.

Open daily from 8 am to 5 pm, the site is available to the public at a charge of 50¢ minimum and 75 ¢ per cubic yard. The waste is spread and compacted with crawler tractors. Because there is very little putrescible material, the waste only needs cover once a week. The limited salvage is frequently removed from the site.

The Alameda County Health Department, Bay Area Air Pollution Control District, and the Regional Water Quality Control Board are responsible for site investigation.

HAYWARD DISPOSAL SITE (606)

The Hayward Disposal Site is located in the unincorporated area of Alameda County near Hayward at the end of West Winton Avenue. Although the entire site covers 525 acres of low-lying marsh land adjacent to San Francisco Bay, the present operation is taking place on 69 acres on the northern portion of the property. This area is expected to have only a short duration as it is filling rapidly with the 145,000 tons of waste it receives each year. An additional 95 acres have received a conditional use permit but this should only be sufficient until 1976. The remaining 291 acres have not been permitted waste disposal activities. the site is owned and operated by the Oakland Scavenger Company and serves the Cities of Castro Valley, Hayward and the Port of San Leandro.

In 1964 the Regional Water Quality Control Board adopted waste discharge requirements for the site. Resolution No. 69-42 allows Group ? wastes to be disposed on the property. Detailed soils investigations of the underlying soil show that at least 40 feet of impervious clay are present making the property suitable for sanitary landfill.

The site is open to the public daily from 8 am to 5 pm with a minimum charge of 50¢ per load and 50¢ per cubic yard.

Compaction is done with crawler tractors and cover applied daily except on the working face. Minimal metal salvage operations are conducted.

The operation complies with current local refuse disposal standards. Various organizations inspect the site regularly including the Alameda County Health Department, the Regional Quality Control Board, and the Bay Area Air Pollution Control District.

TURK ISLAND COMPANY (611)

Placed in operation in 1962, the Turk Island Company comprises 117 acres of low-lying flood plain in Union City. The surrounding area is predominantly agricultural and developing residential. The site is located at 32505 Union City Boulevard, Union City and serves Union City, Hayward, Fremont, Newark, and parts of Alameda County. At the current rate of fill—about 15,000 tons annually—the estimated remaining life of the site is ten years, until about 1982. Recreational use is planned for the filled portions of the site and industrial development is planned for the unfilled areas.

Although the site is defined as Class II, the majority of wastes that go to the site are Group 3 materials from the general public. The household waste in these cities is collected by the Oakland Scavenger Company and goes to the Durham Road site. The site is open to the public from 8 am to 5 pm daily with a minimum charge of 50¢ plus 75¢ per cubic yard.

The waste is placed and compacted with large crawler equipment and since there is very little putrescible waste, the operation is covered only once every 14 days. A sightly appearance is maintained and papers are collected frequently.

The inspection agencies for the site include the Alameda County Health Department, the Bay Area Air Pollution Control District, and the Regional Water Quality Control Board.

FREMONT SITE (612)

This site, owned and operated by the Oakland Scavenger Company, is located in the City of Fremont at the end of Durham Road near the Southern Pacific Albrae Station. It covers 260 acres of level land in the flood plain surrounded mostly by undeveloped area. Opened in 1967, the site serves a population of nearly 145,000 in the Cities of Fremont, Newark, Union City and the surrounding areas in Alameda County. At the current rate of about 2100 tons of waste a week, nearly 110,000 tons a year, the site is expected to last another 28 years.

Heavy compaction of waste is done with crawler tractors. The face is kept to a minimum and cover is applied daily except for the working face. Minimal salvage is done for metals that are periodically hauled away.

The Regional Water Quality Control Board adopted waste discharge requirements for the site in 1967. Under Order No. 67-10, Group 2 wastes are premitted to be disposed.

The Fremont site is open to the public seven days a week from 8 am to 5 pm with a minimum charge of 50¢ and 50¢ a cubic yard for larger loads.

Various inspection agencies include the Alameda County Health Department, the Regional Water Quality Control Board, and the Bay Area Air Pollution Control District.

PLEASANTON PUBLIC DUMP (614)

This gully-canyon site in Alameda County at 2512 Vineyard Avenue serves a population of almost 20,000 in the City of Pleasanton and the surrounding area. The remaining site life has been estimated at four years and Pleasanton Garbage Service, owners and operators of the site, will build a transfer station on the property around 1977. At that time disposal may be diverted to the Eastern Alameda County landfill.

Discharge requirements were adopted in 1971. Order No. 71-17 describes the site as suitable for receiving Group 2 material About 20,000 tons a year are brought here where it is spread and compacted with a crawler tractor achieving good densities. Cover is applied every other day.

Pleasanton Public Dump is open daily from 9 am to 4 pm with a minimum charge of 50¢ per load and $1.00 per cubic yard. Minimal metal salvage is done and the material frequently hauled from the site.

The operation complies with local refuse disposal standards and is inspected by the Alameda County Health Department, Regional Water Quality Control Board, Bay Area Air Pollution Control Board, and the State Division of Forestry

EASTERN ALAMEDA COUNTY DISPOSAL SITE (613)

Located at 4001 North Vasco Road, four miles northeast of Livermore in Alameda County, the site consists of 297 acres of rolling hills and gullies surrounded by grazing land. It serves the communities of Dublin and San Ramon, and the City of Livermore, whose population is nearly 60,000. Ralph Properties, Inc. own the landfill which is operated by De Paoli Equipment, Inc. At the present rate of filling—50,000 tons annually—the site will last well into the next century. As sections are completed, the land is being returned to agricultural use.

If the site is used as the major Alameda Planning Area disposal site, its 10.5-million ton capacity will be sufficient until about 1997. Beyond that time hundreds of acres are available for filling adjacent to the present operation.

The hours for the public are from 8 am to 4:30 pm seven days a week with a minimum charge of 50¢ per load, and $1.00 per cubic yard for large loads.

The Regional Water Quality Control Board adopted waste discharge requirements for the site in Order No. 282.21. The site is designated as Class II.

Compaction and spreading are done with a crawler tractor and cover is applied daily with a self-propelled scraper. No salvaging is permitted.

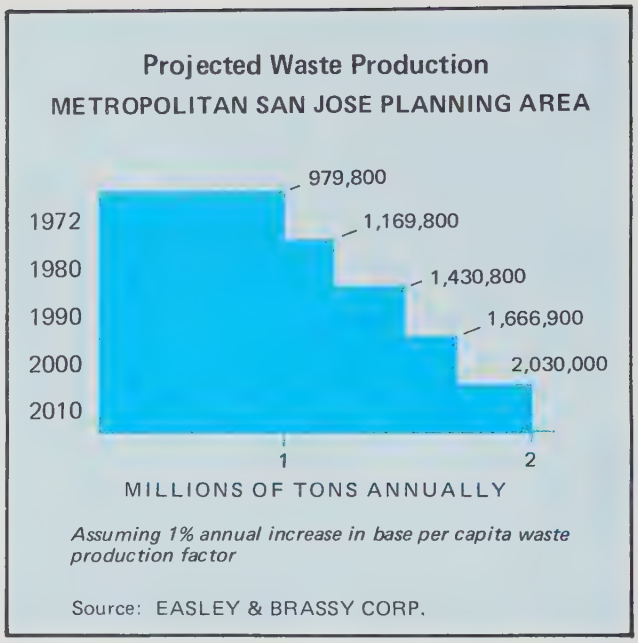
The Alameda County Health Department, the Regional Water Quality Control Board and the State Division of Forestry inspect the site.

Metropolitan San Jose Planning Area

CITY	LANDFILL SITE USED
Campbell	714
Cupertino	707
Los Altos	707
Los Altos Hills .	707
Los Gatos	714
Milpitas	708
Monte Sereno . . .	714
Mountain View .	702
Palo Alto	701
San Jose	708
Santa Clara	705
Saratoga	714
Sunnyvale	704
Portola Valley .	707
Woodside	707

Metropolitan San Jose Planning Area

Distinguished by the broad, fertile Santa Clara Valley formed by the Santa Cruz Mountains and Diablo Range, the Metropolitan San Jose Planning Area was once a rich agricultural area. Although it still produces an abundance of fruits, vegetables, and nuts, much of the valley is now urbanized. Already over a million people live and work in San Jose and the neighboring cities and it is one of the fastest growing areas in the United States. By 2010 the planning area population is expected to reach 1.5 million. The planning area includes all the Santa Clara Valley north of the Santa Teresa Hills as well as Portola Valley and Woodside in San Mateo County.



WASTE MANAGEMENT

Eleven general-purpose landfills serve the area with eight of these clustered in the low-lying flood plain at the southern tip of San Francisco Bay. There is no immediate concern for sufficient land fill space as approximately half of the waste produced in the area is disposed in the Newby Island site (708) which is expected to last until 1985. Palo Alto Landfill (701) will also continue to serve the area until 1985.

Several of the smaller landfill operations have already closed—namely, Customer Utility, Story Road, and Eastdale. And, beginning in the mid-1970's more are scheduled to shut down operations. Singleton Road (711) which has been receiving about 15,000 tons of waste a year from the general public is scheduled to close in 1973.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
METROPOLITAN SAN JOSE PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Campbell	—	11,863	24,770	25,946	28,125	30,303	32,481
Cupertino	—	3,664	18,216	20,431	23,801	27,171	30,541
Los Altos	—	19,686	24,956	27,876	29,724	31,572	33,419
Los Altos Hills	—	3,412	6,865	9,471	12,395	15,319	18,243
Los Gatos	4,907	9,036	23,735	27,036	32,288	37,540	42,792
Milpitas	—	6,572	27,149	33,542	42,508	51,474	60,440
Monte Sereno	—	1,506	3,089	3,627	4,332	5,037	5,741
Mountain View	6,563	30,889	51,092	57,258	61,053	64,849	68,645
Palo Alto	25,475	52,287	55,966	70,646	77,187	83,728	90,269
San Jose	95,280	204,196	445,966	500,479	551,079	601,679	652,279
Santa Clara	11,702	58,880	87,717	88,240	91,660	95,080	98,500
Saratoga	—	14,861	27,110	30,987	36,098	41,209	46,320
Sunnyvale	9,829	52,898	95,408	110,310	127,666	145,023	162,379
Portola Valley	—	—	4,999	5,876	7,089	8,301	9,483
Woodside	—	3,592	4,731	5,634	6,846	8,059	9,272
Unincorporated	—	—	127,965	146,839	164,642	183,496	202,423
TOTAL	—	—	**1,029,734**	**1,164,198**	**1,296,493**	**1,429,840**	**1,563,217**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

Next, in 1974, All-Purpose Landfill (705) serving the City of Santa Clara will close but adjacent property will be used to continue filling operations at the rate of 300 tons a day. Another closing scheduled for 1974 is the Fill Dump Improvement Site (706) that now handles about 135 tons of waste daily. An extension site on adjoining property is now being studied for use when the Guadalupe site (714) which now handles 350 tons of waste daily closes in 1976. Later, around 1980, both the Nine Par Site (707) and the Sunnyvale Specialty Garbage and Refuse Disposal Site (704) are scheduled for completion. At the present time they receive about 350 and 300 tons per day respectively. The Mountain View Site, where 544 acres are being developed as a regional park,is being filled at the rate of 2500 tons of waste a day transferred from San Francisco and with refuse hauled directly from the City of Mountain View. Although this site is expected to provide waste disposal capacity for San Francisco until 1980, investigations have already begun to determine the feasibility of filling adjacent property. This would extend the site life another 10 years until 1990.

FUTURE WASTE MANAGEMENT

Beginning in the early 1980's the San Jose Metropolitan Planning area will be faced with finding capacity for its solid waste produced by the 1.6 million people anticipated at that time. Two landfill sites will be required—one in the eastern part of the planning area, the other in the western part. In the eastern planning area, the Cities of San Jose, Milpitas, part of Santa Clara, Alum Rock, and the unincorporated county will require a capacity for about 16 million tons from 1985 through 2010. In the western planning area the Cities of Los Altos, Los Altos Hills, Woodside, Portola Valley, part of Santa Clara, Sunnyvale, Palo Alto, Cupertino, Mountain View, Saratoga, Campbell, Monte Sereno, and Los Gatos will require a site with about 20 million tons capacity to last until 2010.

As an alternative, one large site of 36-million ton capacity in either part of the planning area would suffice if a transfer station were located for towns too distant for direct haul. A 300- to 400-acre site with canyons 200 to 300 feet deep would provide the necessary capacity. Or a flat area could be used such as the proposal set forth in the Alviso Report. This solution would require between 1000 to 2000 acres of land depending on whether the area were raised 13 or 25 feet above sea level. A large canyon site would require only a fraction of the land proposed in the Alviso Report but raising the Alviso area to prevent flooding and inundation also has merit and would offer a viable solution to both waste management and flood control in the South Bay.

ALVISO REPORT

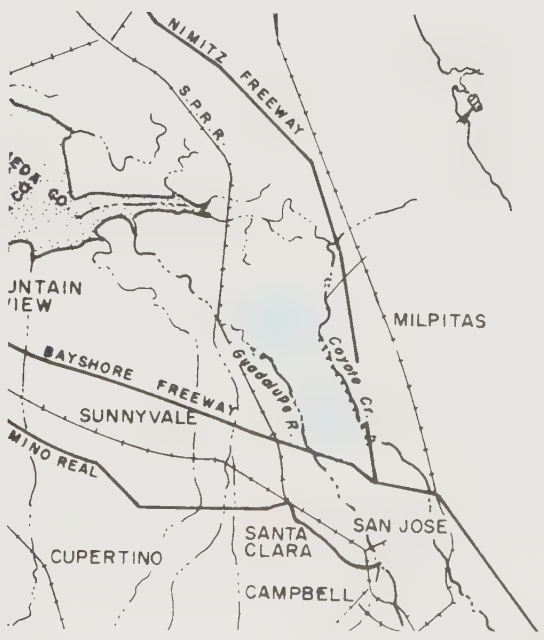
Flooding and inundation have been historical problems in Alviso. Measurements by the U.S.G.S. in 1967 showed the elevation from 2 to 3 feet above sea level. The area is essentially undrained except for a few shallow meandering intermittent stream channels.

A geotechnical study prepared by Cooper-Clark for the City of San Jose during 1970 and 1971 investigated the feasibility of solving local subsidence problems by using sanitary landfill. The study area was approximately 5200 acres in the northwestern portion of Santa Clara County between Brokow Road and the northern limits of the City of Alviso. It was bounded on the west by the Guadalupe River and Bayshore Freeway and on the east by Coyote Creek and the Nimitz Freeway.

The study suggested raising subsided lands with a sanitary landfill. Calculations indicate that approximately 16.5 million tons of refuse could raise the elevation to 13 feet. Data indicates that the natural soils underlying the sanitary fill would generally be sufficiently impervious to prevent pollution of groundwater or adjacent bodies of water. With special construction and monitoring techniques, the fill would meet current Class II disposal site standards.

Although there has been no concerted drive to establish the Alviso area as a regional disposal site, this proposal offers a viable solution both to waste management and flood control in the South Bay.

STUDY AREA



PLANNING AREA DISPOSAL SITES

PALO ALTO LANDFILL (701)

The Palo Alto Landfill is 154 acres of marsh land located at the east end of Embarcadero Road in Palo Alto. It serves the City of Palo Alto and Stanford University with a combined population of about 65,000. The site was opened about 1920 and is expected to continue operating for another 13 years or more if a second lift is placed. At that time the site is expected to be used for recreation.

The site has not received waste discharge requirements from the Regional Water Quality Control Board but accepts Group 2 wastes. These are compacted and spread with a compactor and covered daily, except for the face which is kept to a minimum. Salvaging is not permitted.

Palo Alto Landfill is open from 8 am to 5 pm daily to the general public and authorized private collectors under contract with the City. For loads up to 1½ cubic yards residents pay no fee and non-residents pay $2.00. Fee schedules for residents and non-residents alike are applied to larger loads.

The County Health Department and the City of Palo Alto are among the agencies that inspect the site.

SUNNYVALE SPECIALTY GARBAGE AND REFUSE DISPOSAL SITE (704)

Surrounded by industrial areas in Sunnyvale, this site consists of 90 acres of marsh land. It is on the northern side of Caribbean at Crossman and Borreges. It has been open since 1920 and is expected to operate until 1980 when it will probably be used for recreation. A replacement site is not being considered. The site serves Sunnyvale's 97,000 population.

Crawler tractors spread and compact wastes which are covered every 72 hours. Salvaging is not pemitted.

Although the Regional Water Quality Control Board has not specified waste discharge requirements the site received about 300 tons a day, mostly of Group 2 wastes. It is open to the general public and private collectors from 8 am to 5 pm daily except holidays. There is a 25¢ fee for a minimum load and 50¢ per cubic yard.

Inspection agencies for the site include the Sunnyvale Department of Public Works and Fire Department, and the Bay Area Air Pollution Control District.

MOUNTAIN VIEW DISPOSAL SITE (702)

This site in Mountain View covers 544 acres of low land at the northern end of Stierlin Road surrounded by agricultural land and salt ponds. About 2500 tons a day of Group 2 wastes generated by 780,000 people in San Francisco, Treasure Island, and Mountain View are brought here. Although the site was opened in 1930, the major filling did not begin until 1970. It is expected to continue for another seven years when the site will become a regional recreational area. The completed facility, Shoreline Regional Park, will have a championship golf course, lakes, picnic grounds, swimming pools, tennis courts, and a small boat lake.

Waste spreading and compaction is done with a crawler tractor and compactor. There is daily covering including the face. No salvaging is permitted.

Open Monday through Friday from 5 am to 5 pm, the site is available only to private collectors at $1.68 per ton. Waste discharge requirements from the Regional Water Quality Control Board are outlined in Order No. 70-67.

Agencies responsible for inspection include the Regional Water Quality Control Board, Bay Area Air Pollution Control District, the City of Mountain View, and the Army Corps of Engineers.

STIERLIN ROAD DISPOSAL SITE (703)

Stierlin Road Disposal Site is a 45-acre tidal area surrounded mostly by agricultural land. It is located at the north end of Stierlin Road in Mountain View. The general public in Mountain View, Los Altos, and adjoining unincorporated areas use this site. Each day about 50 tons of waste are received, compacted and spread with a compactor, and covered, except for the face. The site opened in 1964 and is expected to continue operating until 1977 when a replacement site, already acquired, will be used. There is a detailed plan for future recreational use of the Stierlin Road Site.

It is open from 8 am to 5 pm daily and is available to the general public and private collectors. Fees are 50¢ for a minimum load and $1.00 per cubic yard. Cars are charged 50¢ and station wagons charged 75¢.

The site has received waste discharge requirements under the Regional Water Quality Control Board No. 2, Order No. 71-50 on June 24, 1971. The site accepts Group 2 wastes.

ALL-PURPOSE LANDFILL (705)

The All-Purpose Landfill at 5200 Lafayette in Santa Clara is a 73-acre site on former agricultural land. It serves about 92,000 people from the City of Santa Clara and surrounding area receiving about 150 tons a day of Group 2 wastes. The site opened in 1965 and is expected to continue operating until February 1, 1974 when it will probably be used for light construction and/or recreation. A replacement site has already been acquired.

The site has received waste discharge requirements from the Regional Water Quality Control Board. It is open from 8 am to 5 pm daily and is available to the general public as well as public and private collectors. The fee is 75¢ minimum and 50¢ per cubic yard.

A crawler tractor is used to spread and compact wastes which are covered every 72 hours. Salvage operations recover materials which are frequently hauled from the site.

The Regional Water Quality Control Board and the City of Santa Clara inspect the landfill.

NINE PAR DISPOSAL SITE (707)

The Nine Par Disposal Site on Los Esteros Road, Alviso is 70 acres of marsh land surrounded mostly by undeveloped area. It serves about 80,000 people in Woodside, Portola Valley, Los Altos Hills, Los Altos, Cupertino, and Santa Clara. About 350 tons of refuse are brought here daily. The site opened around 1934 and is expected to operate for another seven years. The use of the completed site has not yet been considered but a replacement is being studied.

The site is open to the general public and also public and private collectors from 5 am to 4 pm six days a week and closed on Sundays. There is a minimum load charge of $1.25 and 75¢ compacted and 50¢ uncompacted per cubic yard. The Regional Water Quality Control Board has not yet issued water discharge requirements for the site.

Compaction and spreading are done with a crawler tractor and the wastes, including the face, are covered daily. Salvaging is not permitted on the site.

The site is inspected by the Santa Clara County Health Department and the Regional Water Quality Control Board.

FILLDUMP IMPROVEMENT SITE (706)

The Filldump Improvement Site at 1700 Gold Street, Alviso is operated by the Marshland Development Company. It covers 53 acres of marshland surrounded mostly by undeveloped land. The site receives about 500 tons of refuse a day from demolition contractors serving Santa Clara County. It is open from 6:30 am to 5:30 pm daily and charges 50¢ per cubic yard. The Regional Water Quality Control Board has not adopted waste discharge requirements for this operation which only accepts Group 3 wastes.

A bulldozer spreads and compacts wastes which are covered daily. Covering also includes the face. Controlled salvage operations are permitted and recovered materials removed frequently.

NEWBY ISLAND SITE (708)

The Newby Island site in San Jose covers 344 acres of low land at the western end of Dixon Landing Road. It serves all of San Jose and Milpitas, and parts of Santa Clara County—a service population of 474,000. Opened in 1930, the site is expected to operate until 1985. At that time it probably will be used for an industrial park or golf course.

About 1100 tons a day of Groups 2 and 3 wastes are accepted at the site which has not yet received waste discharge requirements from the Regional Water Quality Control Board.

For collectors, the site is open 24 hours a day Monday through Friday but only from 6 am to 4 pm on the same days for the general public. The fee is 75¢ for a minimum load and 75¢ per cubic yard.

A compactor spreads and compacts wastes which are covered daily except for the face. Salvaging is not permitted.

The site is inspected by the Bay Area Air Pollution Control District and the Santa Clara Department of Public Health.

SINGLETON ROAD DISPOSAL GROUNDS (711)

These grounds cover 14 acres of level terrain surrounded mostly by residential and undeveloped areas. Located at 885 Singleton Road in San Jose next to Coyote Creek, it serves the communities in Santa Clara County and the southeastern portion of San Jose. The site was opened in 1966 and will be filled by the end of 1973. At that time the City of San Jose plans to purchase the site for a park and recreational area. A replacement site is being planned.

The waste discharge requirements from the Regional Water Quality Control Board 2 have been received under Order No. 71-7. Only 40 tons per day of Group 2 wastes are received. Singleton Road is open to the public 7 days a week from 8 am to 5:30 pm. There is a 75¢ charge for a minimum load and per cubic yard.

A compactor compacts and spreads wastes which are covered every other day. Materials recovered by on-site salvage operations are removed every day.

The Santa Clara County Health Department and the Regional Water Quality Control Board are the agencies responsible for site inspection.

GUADALUPE (714)

The Guadalupe site south of San Jose is 40 acres of gully-canyon surrounded mostly by undeveloped land. It serves a population of about 75,000 in the communities of Campbell, Los Gatos, Saratoga, Monte Sereno and the surrounding unincorporated areas. The site, located on Guadalupe Mine Road, opened in 1931 and is expected to continue operating for another three years. The use of the completed site has not yet been considered and a replacement site is being studied.

About 350 tons of Group 2 wastes are accepted here daily. Compaction and spreading are done with a crawler and wastes are covered every 72 hours. No salvaging is permitted. Waste discharge requirements have not yet been adopted by the Regional Water Quality Control Board.

Guadalupe site is open from 8 a.m. to 5 p.m. daily to the general public and private collectors. A fee of 50¢ per minimum load and $1.00 per cubic yard is charged.

Inspection agencies for the site include Santa Clara County Health Department and the Regional Water Quality Control Board.

G & M CONSTRUCTION (719)

The G & M Construction Site is 7 acres of borrow pit surrounded by residential areas. It is located in San Jose at the west end of Melbourne Avenue east of the railroad tracks. The site receives about 80 tons of waste a day from demolition trucks. it opened in April 1970 and is expected to remain open until mid-1973 when it will probably be used for recreation. A replacement site has not yet been considered.

The site is always open but available only to the operator. Waste discharge requirements have been established by the Regional Water Quality Control Board 2 and the site accepts Group 3 wastes which are compacted with a crawler tractor. Cover is applied every 72 hours. No salvaging is permitted.

CITY OF SAN JOSE DISPOSAL GROUNDS (712)

These disposal grounds, operated by the City of San Jose Department of Public Works, covers 62 acres of level ground surrounded mostly by agricultural land. It is located in San Jose three quarters of a mile northwest of Senters Road at Ingleton. About 150 tons of Group 2 wastes are received here from Santa Clara County and the southeast portion of San Jose. Operation began in 1967 and is expected to continue another 15 years. At that time it will be developed as a golf course. A replacement site has not been considered.

Waste discharge requirements have been established for the site under Order No. 71-6.

The disposal facilities are open daily from 8 am to 4:30 pm at a 50¢ non-commercial minimum load charge and 75¢ commercial rate per cubic yard.

A crawler is used to compact and spread wastes which are covered weekly. Materials recovered from salvage operations are removed frequently.

Site inspection agencies include the City of San Jose, Santa Clara County Department of Public Health, Bay Area Air Pollution Control District, and the Regional Water Quality Control Board.

South Santa Clara Planning Area

PLANNING AREAS

1 West Marin
2 East Marin
3 Sonoma North Coastal
II Central Sonoma
5 Northeast Sonoma
6 Napa Valley
7 Napa Solano
III East Solano
9 Central/East Contra Costa
10 West Contra Costa
11 Alameda
12 Metropolitan San Jose
13 South Santa Clara
14 San Francisco and Peninsula

CITY	LANDFILL SITE USED
Gilroy	716
Morgan Hill	715
San Martin	718

South Santa Clara Planning Area

The narrow Santa Clara Valley south of the Santa Teresa hills makes up the South Santa Clara Planning Area. It is home for 32,000 people mostly clustered in and around Morgan Hill, San Martin, and Gilroy. Forecasts predict a high growth rate with an estimated 135,000 people living in the planning area by 2010.

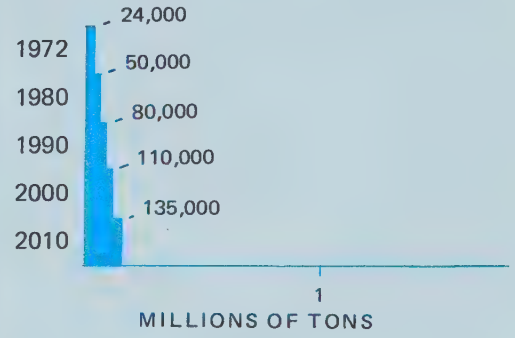
WASTE MANAGEMENT

Four landfills currently serve the area which generated 24,000 tons of refuse in 1972. Three of these sites are now being closed or phased out and, by 1974, one site will accomodate the entire area.

Although the Morgan Hill site has capacity for about 20 more years, the freeway planned for this area is expected to cut through it and effectively end its operation in the mid-1970's. At that time the waste—2300 tons annually in 1972— will be hauled directly to the Pacheco Pass Site (716). Similarly, the San Martin Site (718) is being converted to a small transfer operation to serve the general public. While the Morgan Hill Site (715) operates, waste from San Martin is hauled there. But when it closes, San Martin waste will also be disposed at the Pacheco Pass Site.

The Gilroy Site (717) serves the Gilroy area for six months of the year while the Pacheco Pass Site (716) serves the same area the remaining six months. Gilroy (717) is expected to be closed permanently in 1974 when Pacheco Pass (716) will begin operating year round. The Pacheco Pass Site is a 72-acre canyon with about 2.9 million tons capacity. This is sufficient to carry the planning area through 1992 without purchasing additional landfill capacity. From 1992 to 2010, an additional four million tons of waste will be produced in this planning area.

Projected Waste Production
SOUTH SANTA CLARA PLANNING AREA



Assuming 1% annual increase in base per capita waste production factor

Source: EASLEY & BRASSY CORP.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
SOUTH SANTA CLARA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
Gilroy	4,351	7,348	12,665	20,724	30,756	40,789	50,821
Morgan Hill	1,627	3,151	6,485	10,313	16,348	22,389	28,417
San Martin	–	–	2,142	3,921	5,534	7,618	9,656
Unincorporated	–	–	11,011	16,711	26,744	36,776	46,808
TOTAL	–	–	**32,303**	**51,669**	**79,382**	**107,572**	**135,702**

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

PLANNING AREA DISPOSAL SITES

MORGAN HILL SITE (715)

This site serves about 7000 people in the communities of Morgan Hill, Madrone, Coyote, and San Martin. it consists of 53 acres of quarry pits located in the vicinity of Burnett Avenue. The surrounding area is mostly agricultural. About 10,000 tons a year are disposed at the site. Access is restricted to the operator. It opened in 1951 and will cease to operate if and when a proposed highway is built. A replacement site is being studied.

The Regional Water Quality Control Board has not yet adopted waste discharge requirements.

Compaction and spreading is done with a crawler tractor and wastes are covered daily except for the face. Salvaging is not permitted.

The Santa Clara County Refuse Disposal Agency inspects the site.

PACHECO PASS SITE (716)

The Pacheco Pass Site southeast of Gilroy consists of 72 acres of gully-canyon in a predominantly agricultural area at the east end of Bloomfield road near the Pacheco Pass Highway. South Valley Refuse Disposal, Inc. is responsible for its operation which serves the summer population of 13,000. About 40 tons of waste a day are disposed here. The site was opened in 1965 and is expected to continue operating for at least another 19 years. The use of the completed site and a replacement site have not yet been considered.

Wastes are compacted and spread with a crawler tractor and cover is applied daily including the face. No salvage operations are permitted.

Use of the site is limited to the operator only.

Waste discharge requirements have been adopted by the Regional Quality Control Board. The Santa Clara County Refuse Disposal Agency is responsible for inspection.

GILROY SITE (717)

Nine acres of level land are being used for this operation. The site, located at Luchessa Road and Liagas Creek in Gilroy, is surrounded mostly by agricultural land. It serves about 13,000 people in Gilroy. South Valley Refuse Disposal, Inc. operates the site which accepts about 40 tons a day of Group 2 and Group 3 wastes. Operations began in 1955 and are expected to continue until 1974. The use of the completed site has not been considered.

The site is only open during the winter months from 8 am to 5 pm daily. The general public and private collectors may bring refuse to the site which charges 50¢ for a minimum load and 50¢ for a cubic yard.

The Regional Water Quality Control Board has not established waste discharge requirements.

A crawler tractor spreads and compacts wastes. The face is covered daily during the six months of the year when the site is operating. Controlled salvaging is permitted and recovered materials are stored on site.

The Santa Clara County Refuse Disposal Agency inspects the site.

SAN MARTIN SITE (718)

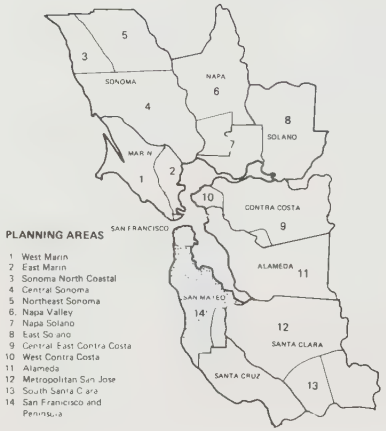
This 9½-acre level site is located in the vicinity of Liagas and North Street in San Martin. Residential districts surround the operation which is run by South Valley Refuse Disposal, Inc. It serves a population of 6000 in San Martin, parts of Morgan Hill, and some of the surrounding unincorporated areas of Santa Clara County. About 5200 tons a year of Groups 2 and 3 wastes are disposed here. It began operating in 1968 and will continue until 1973, when the site will be used for a compactor transfer station.

The general public may use the site which is open from 8 am to 5 pm daily except Sunday. There is a 75¢ minimum load charge and 75¢ per cubic yard.

A crawler tractor is used to compact and spread wastes which are covered every 24 hours including the face.

The Santa Clara County Refuse Disposal Agency inspects the site.

San Francisco and Peninsula Planning Area



CITY	LANDFILL SITE USED
San Francisco ..	702
Belmont	815
Brisbane	815
Burlingame	815
Colma	815
Daly City	809
Half Moon Bay .	815
Hillsborough ...	815
Menlo Park	806
Millbrae	815
Pacifica	809
Atherton	815
Redwood City .	806
San Bruno	815
San Carlos	815
San Mateo	815
So. San Francisco	815

San Francisco and Peninsula Planning Area

The northern stretch of the Santa Cruz Mountains form the backbone of the peninsula occupied by San Mateo County. The eastern, or Bay, side of the hills are heavily populated with 550,000 people in the San Mateo County portion of the planning area. Added to the 715,000 population in San Francisco, the current planning area total population is 1,270,000.

WASTE MANAGEMENT

Currently there are nine general-purpose landfill sites and three transfer stations serving the area. The two largest landfill operations—Marsh Road (815) and the South County Disposal District (806) are expected to be filled by 1975. Together these operations handle about 900 tons a day serving all of San Mateo County within the planning area except Daly City and Pacifica. These two cities use the Daly City Disposal Site (809) which is expected to last until about 1997.

The other planning area sites, Junipero Serra (808), Hillside Rubbish (807), Burlingame (803), San Mateo (804), Half Moon Bay (812), and Pescadero (814) are all small operations serving the nearby general public. Although all these sites will be closing at different times over the next five to ten years, the impact on the solid waste planning area will be slight. A replacement site in an adjacent canyon has already been acquired for use when the Pescadero Site (814) closes in 1974. As the other sites close, transfer stations will be used more by the general public and possibly one or two mini transfer stations could be established for greater public convenience.

PAST[1] AND PROJECTED[2] POPULATION GROWTH
SAN FRANCISCO AND PENINSULA PLANNING AREA

	1950	1960	1970	1980	1990	2000	2010
San Francisco	775,357	740,316	715,674	720,432	724,892	730,123	732,481
Belmont	5,567	14,996	23,667	26,601	30,567	32,483	33,281
Brisbane	–	–	3,003	3,367	3,870	4,374	4,878
Burlingame	19,886	24,036	27,320	29,348	30,421	31,687	32,421
Colma	297	500	537	592	601	643	722
Daly City	15,191	44,791	66,922	70,214	76,415	82,616	88,817
Half Moon Bay	–	1,957	4,023	5,310	6,919	8,528	10,137
Hillsborough	3,552	7,554	8,753	8,823	8,945	9,123	9,215
Menlo Park	13,587	26,957	26,734	27,031	28,578	30,126	31,673
Millbrae	8,972	15,873	20,781	21,038	22,439	22,674	22,957
Pacifica	–	20,995	36,020	39,404	42,712	46,021	49,329
Atherton	3,630	7,717	8,085	8,441	8,689	8,936	9,183
Redwood City	25,544	46,290	55,686	64,937	72,640	81,932	93,560
San Bruno	12,478	29,063	36,254	37,898	40,411	42,923	45,435
San Carlos	41,371	21,370	25,924	26,960	28,257	29,553	30,849
San Mateo	41,782	69,870	78,991	86,781	96,999	107,218	117,437
South San Francisco	19,351	39,418	46,646	49,655	53,389	57,122	60,856
Unincorporated	–	–	81,793	99,989	122,737	145,484	168,231
TOTAL	–	–	1,266,813	1,326,821	1,399,481	1,471,566	1,541,462

Source: 1 - U.S. CENSUS
2 - EASLEY & BRASSY CORP.

When the Marsh Road (815) and South County Disposal District (806) sites close the current plan is to establish a new transfer station (8T3) south of Highway 92 along the Bayshore Freeway to save collection trucks from making the winding drive along Highway 92. Waste would be hauled from this station by transfer trucks to the Ox Mountain Disposal site (890) near Half Moon Bay. A proposed freeway parallel to Highway 92 would ease traffic to the Mountain site but, with the recent pressure by conservation groups, it will be years—if ever—before it is built.

The Ox Mountain Site (890) can accomodate 18 million tons of refuse. This capacity would serve planning area cities using the site about 23 years or until 1996. About 1987 San Francisco will fill the Mountain View property and may use Ox Mountain. Later, about 1996, Daly City and Pacifica will also need disposal space. So, between 1996 and 2010, approximately 22 million tons of space need to be reserved. The Apanolio Canyon in the Ox Mountain Site (890) has reserve capacity for 14 million tons that would accomodate the additional requirements until 2006.

The three transfer stations now operating serve the north tip of the planning area. Solid Waste Engineering and Transfer Systems (9T1) operate the largest station which handles 2100 tons of waste daily from San Francisco and hauls it by truck to the Mountain View Site (702) in Santa Clara County. South San Francisco Transfer Station (8T2) and San Bruno Transfer Station (8T1) together haul a total of almost 200 tons a day to the Marsh Road Site (814). When Marsh Road closes, waste from both stations will be hauled in transfer trucks to the Ox Mountain Site (890). With these three transfer stations already operating in the northern part of the planning area no additional stations need to be built for this area. The only new station required—Station 8T3—would serve the southern part of the Bay side of the Peninsula.

PLANNING AREA DISPOSAL SITES

BURLINGAME DISPOSAL SITE (803)

The Burlingame Disposal Site at 1001 Airport Boulevard is 90 acres of marshes surrounded mostly by commercial land. It serves the general public from the communities of Burlingame, Millbrae. Hillsborough, a portion of San Mateo, and the unincorporated surrounding areas. The site opened about 1950 and is expected to continue for another five years. There is a detailed plan for the completed site which will be used for recreation and a replacement site is now being studied.

About 70 tons of waste a day are brought here, compacted and spread with a crawler tractor, and covered every other day. Controlled salvaging is permitted and materials are frequently removed from the site.

Burlingame Disposal Site is open to the general public from 8 am to 5 pm daily with a 25¢ minimum load charge and 50¢ per cubic yard. Other waste from this service area is collected by the San Mateo County Scavengers and disposed at Marsh Road Sanitary Landfill. The site has received waste discharge requirements under Order Number 67-68 from the Regional Water Quality Control Board No. 2.

The City of Burlingame and San Mateo County Health Department inspect the site.

SAN MATEO DISPOSAL SITE (804)

The San Mateo Disposal Site at the end of Third Avenue is 20 acres of marshes surrounded mostly by undeveloped land. It serves the general public in San Mateo and Hillsborough, portions of San Carlos, and the surrounding unincorporated areas. The site receives about 50 tons of waste a day. It was opened in 1951 and is expected to operate for another three to five years. The future use of the site has been conceptually planned for recreation and a replacement site has been planned.

The site is open from 8 am to 5 pm daily to the general public with a minimum charge of 50¢ and $1.00 per cubic yard. Other waste from this service area is collected by the San Mateo County Scavengers and is disposed at Marsh Road Sanitary Landfill. The site has received waste discharge requirements from Regional Water Quality Control Board No. 2 and accepts Group 2 wastes. These are compacted and spread with a crawler tractor and covered every 24 hours. Salvaged materials from a controlled operation are stored on site.

The site is inspected by the San Mateo County Health Department and County Engineer, the City of San Mateo Department of Public Works, Regional Water Quality Control Board, State Department of Public Health, and the Bay Conservation and Development Commission.

SOUTH COUNTY DISPOSAL DISTRICT (806)

The South County Disposal District in Menlo Park is located at the east end of Marsh Road. It is 47 acres of marsh land surrounded by industrial areas. The site receives about 350 tons a day of solid waste from Redwood City and Menlo Park and the South County District with a combined population of 165,000. Operations began in 1957 and the site is expected to close in 1974. The use of the completed site has been conceptually planned for recreational use. When the site closes waste will go to Marsh Road Site (815) until a replacement site, which is now being studied, is opened.

South County Disposal District is open seven days a week from 8 am to 5 pm to the general public and private collectors. There is a 25¢ minimum load charge and 50¢ per cubic yard.

Heavy compaction and spreading are done with crawler tractors. No salvaging is permitted.

Waste discharge requirements have been adopted by the Regional Water Quality Control Board No. 2 under Order No. 71-77. The site is classified as Class II.

HILLSIDE RUBBISH (807)

The Hillside Rubbish site is located in Colma along Hillside Road. The site, at the base of San Bruno Mountain, is operated by the Colma Dump Co. It serves the general public in the area and handles much of the demolition refuse from the City of San Francisco. Waste is compacted and spread with a loader and crawler tractor. The estimated half million tons of remaining capacity should keep the site operable about four more years at present filling rates.

The site is inspected by the San Mateo County Health Department, Regional Water Quality Control Board, and State Department of Public Health.

JUNIPERO SERRA SITE (808)

The Junipero Serra site is located in Colma along Highway 280. It is operated by the Colma Dump Company and serves the general public in Daly City, San Bruno, Pacifica, and South San Francisco. About 50 tons a day are disposed, and compacted and spread with a crawler tractor. The site is expected to close by 1975.

Agencies responsible for inspection include the San Mateo County Health Department, Regional Water Quality Control Board, and the State Department of Public Health.

DALY CITY DISPOSAL SITE (809)

The Daly City Disposal Site is reached from the Pacifica Exit of Highway 1. It is 43 acres of hilly terrain surrounded mostly by undeveloped land. The site was opened in 1959 and is expected to operate for another 24 years. At that time it will be used for recreation. In the meantime, a replacement site is being studied.

The site receives approximately 145 tons of waste a day from Daly City and Pacifica with a combined population of 100,000. Wastes are compacted and spread with crawler tractors and covered daily including the face. No salvaging operations are permitted.

The site has not yet received waste discharge requirements from the Regional Water Quality Control Board but accepts mostly Group 2 wastes. It is inspected by the San Mateo County Health Department, City of Daly City, and Regional Water Quality Control Board.

The Daly City site is open five days a week and closed on Saturday and Sunday.

HALF MOON BAY DISPOSAL SITE (812)

The Half Moon Bay Disposal Site is owned by San Mateo County and operated under contract by the Andreni Bros. Company. It is 12 acres of gully terrain one mile west of Highway 2 on Poplar Street next to the Pacific Ocean. Only 3500 tons of waste a year are received here but it is expected that the site will be closed by 1975. A detailed plan has been developed for filling the site with a recreational facility planned for its future use. When the site is phased out, the community will probably use the Ox Mountain Site.

The Regional Water Quality Control Board has not adopted waste discharge requirements for this site but it is being operated as a Class II only accepting Group 2 wastes except for wet garbage. Mostly construction debris, brush and stumps, appliances and rubbish from the general public are received here. The normal household garbage and waste from the communities of Half Moon Bay and the surrounding area—less than 10,000 population—is collected by the San Mateo County Scavenger Company and hauled to the Marsh Road Disposal Site.

Half Moon Bay Disposal Site is open five days a week from 9 am to 4:30 pm and closed on Tuesday and Wednesday. It is open to the general public with a minimum charge of 25¢ per load and 50¢ per cubic yard.

The waste is placed and compacted with a crawler tractor and completely covered each day with a layer of earth. There have been no problems with fires and the operation has generally been trouble-free.

The San Mateo County Engineering Department and Public Health Department inspect the site.

PESCADERO DISPOSAL SITE (814)

The Pescadero Disposal Site is owned by San Mateo County and operated under contract to a private individual. It is located east of Highway 1 on County Road 35. The site which opened in 1963 consists of less than three acres of marsh land adjacent to the county corporation yard. The surrounding area is mostly undeveloped with some agriculture. Less than 2000 tons of waste a year are received and the estimated remaining life is one year. At that time, the land will be used as a parking area for the county corporation yard. A 54-acre replacement site is being planned about one mile from the existing site. If acquired, this would provide the area with disposal facilities for many years.

Discharge requirements have not been adopted for the site but it accepts only Group 2 wastes excluding wet garbage. It receives mostly rubbish, brush, some tires, and street sweepings. The household waste from Pescadero is collected by the San Mateo County Scavengers and disposed at Marsh Road Sanitary Landfill. Pescadero Disposal Site is open to the public from 9 am to 4:30 pm daily except Tuesday and Wednesday when it is closed. The minimum charge is 25¢ per load and 50¢ per cubic yard.

The waste is spread and compacted with a small crawler tractor and covered with earth every 24 hours.

The site is inspected by the County Engineering Department and Public Health Department.

MARSH ROAD SANITARY LANDFILL (815)

This sanitary landfill site which began operating in 1971 is located in Menlo Park east of Highway 101 on Marsh Road. It covers 50 acres of marsh and flood plain typical of the surrounding area. A population of 456,000 is served by the site including the entire Bay side of San Mateo County plus the communities of Half Moon Bay and Pescadero.

The landfill is operated by the San Mateo Disposal Company and is available only to private collection companies at the rate of $3.48 per ton. It may be used by the public at a later date at the direction of the City of Menlo Park. In the meantime, there is an adjacent public disposal area operated by the South County Refuse Disposal District.

At the rate of approximately 550 tons of waste a day, the site is expected to last until 1976. At that time it will be converted to a recreational area and the waste will be diverted to the Ox Mountain Site in Corinda Los Trancos Canyon near Half Moon Bay.

In 1970 the Regional Water Quality Control Board adopted waste discharge requirements for the site. Order No. 70-78 defines the site as acceptable for Group 2 wastes. These are compacted and spread with a compactor and crawler tractor with the working face kept to a minimum. Cover is applied daily. There is a truck scale at the site and accurate records are kept on tonnages and filling sequence. Salvage is not permitted.

OX MOUNTAIN SANITARY LANDFILL SITE (890)

On October 27, 1965 the Planning Commission of San Mateo County granted the San Mateo County Scavenger Company a dump site use permit and on-site grading permit for the Ox Mountain Sanitary Landfill in Corinda Los Trancos Canyon. Both permits were granted for a 20-year period starting from the date of approval provided that, at the end of each one-year period, the Planning Commission would review the operating conditions set forth and revise them to ensure that the dump site is operated to assure public health, welfare, safety, and convenience.

The Regional Water Quality Control Board passed Resolution No. 791 on October 20, 1966.

In July 1970 the San Mateo County Scavengers began site improvements in accordance with the approved plans and have since built access roads, surface and underdrainage facilities, a silt settlement basin, and have landscaped the area.

To date, filling operations have not started at Ox Mountain and are not scheduled to begin until the Marsh Road Landfill site has completed operations. When operations begin at Ox Mountain refuse will be hauled from Bay side cities in special transfer trucks over Half Moon Bay Road. The sanitary landfill will begin in the Corinda Los Trancos Canyon that can hold approximately 7 million cubic yards. When this canyon is filled waste will go the Apanolio Creek site which can accomodate 23 million cubic yards. The total equivalent of the Ox Mountain Site is 20 million tons of waste. By increasing its final elevation 100 feet, the Apanolio Canyon will gain an additional 26-million cubic-yard capacity.

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GOVERNMENT AND PRIVATE INDUSTRY

The current solid waste management situation in the Bay Area can best be described as intricate. A myriad of government bodies operating at every level — federal, state, regional, county, and municipal — as well as private interests are all part of — and affected by — the fragmented control and lack of coordination which characterize the system. In general, government involvement is focused on policy-making and regulatory activities compared to private involvement which has been primarily in the area of collecting and disposing refuse.

On the federal level, government works mainly through the Environmental Protection Agency and the U.S. Army Corps of Engineers in a regulatory capacity. In California, municipal collection, transfer station operations, disposal sites, financing, engineering, regulation, permit issuance, funding, research contracting, safety, and franchising all fall within the realm of government functions. The recent passage of Senate Bill 5, the Solid Waste Management and Resource Recovery Act of 1972, consolidated State controls with the Solid Waste Management Board. Until it was passed in 1972 no one agency in California was responsible for solid waste management. Efforts were spread among the State Water Resource Control Board, Air Resources Board, and the Department of Health, Bureau of Vector Control.

In the San Francisco Bay Region, compared to the entire state, government is more involved in regulating solid waste management than in actually providing service which is franchised or licensed to private collectors. Government activity at all levels in the Bay Area is concentrated in the areas of regulation and permit approval with a multitude of agencies assuring environmental protection. Before any new disposal project can begin, at least 7 federal, 17 state, and 17 local agencies must be consulted and satisfied. In addition citizen action group meetings and public hearings are an integral part of each new permit.

FEDERAL ROLE

The federal role in regulating waste disposal began in 1899 when the Refuse Act assigned the Secretary of the Army jurisdiction over waste disposal in navigable waters and prohibited refuse disposal into navigable waters of the U.S. and tributaries as well as on the banks of these waters. A 1971 interpretation of that Act by the San Francisco Corps of Engineers extended the limits of their authority to include all of San Francisco Bay and much of the low adjacent area. What this means is that the Corps has jurisdiction over nearly 20 disposal sites around the Bay. Already

Agencies and Associations Involved in Approving California Landfills

FEDERAL AGENCIES

Enviromental Protection Agency — Region IX
U.S. Forest Service
U.S. Bureau of Land Management
U.S. Bureau of Indian Affairs
U.S. Army Corps of Engineers
U.S. Department of Transportation
U.S. Coast Guard

STATE AGENCIES

State Water Resources Control Board
- Division of Water Rights
- Division of Water Quality Control
- Division of Planning and Research
- Legal Division
- Department of Water Resources

Department of Conservation
Department of Fish and Game
Department of Parks and Recreation
Air Resources Board
Reclamation Board
Bay Conservation and Development Commission
California Department of Public Health
- Bureau of Vector Control and Solid Waste Management
- Bureau of Sanitary Engineering

State Division of Forestry
State Lands Commission

LOCAL AGENCIES

County Health Department
County Flood Control District
County Engineer — Project Planning and Pollution Control Division
County Engineer — Water Works and Utilities Division
County Department of Public Works
Air Pollution Control District
County Road Department
County Sanitation Department
County Sanitation District
County Water District
County Planning Commission
County Board of Supervisors

City Public Works
City Engineer
City Water Department
City Planning Commission
City Council

OTHER GROUPS

Association of Bay Area Governments
California League of Cities
League of Women Voters
Homeowners Associations
Conservation and Citizens Action Groups

Source: EASLEY & BRASSY CORP.

they have issued some directives calling for immediate discontinuation of landfilling operations within their jurisdiction subject to a $2,500-a-day fine. Permits for landfill issued by the Army are contingent upon approval by many agencies including certification by the Regional Water Quality Control Board assuring the proposed disposal site is environmentally sound.

It was not until 1965 that the federal government began to come to grips with the increasing deluge of waste. In that year Senate Bill 306, the Solid Waste Disposal Act of 1965, was adopted and five years later amended by HR 11833, the Resource Recovery Act of 1970. This legislation places primary responsibility for administering its provisions with the Secretary of Health, Education, and Welfare, and secondary responsibility with the Secretary of the Interior.

In summary, this far-reaching legislation

—promotes public and private research, demonstration, and development programs for new and improved methods of collecting and processing solid waste, recovering and recycling materials and generating energy, and safely disposing nonrecoverable residues.

—provides for special study and demonstration projects on recovery of useful energy and materials from solid waste with recommended uses of such materials, potential markets, and the impact of distribution of such resources on existing markets. The Act supports investigation into current product characteristics and production packaging practices which would reduce the amount of solid waste; how Federal procurement can be used to develop market demand for recovered resources and incentives to accelerate reclamation or recycling; how existing public policies including subsidies, percentage depletion allowances, capital gains treatment and other tax incentives and disincentives effect recycling and conservation of materials; determining the necessity and methods of imposing disposal charges on packaging, containers, vehicles, and other manufactured goods to reflect the cost of final disposal; determine the value of recoverable components as well as any social costs associated with non recycling or uncontrolled disposal of such items.

—encourages cooperative activities by the states and local governments to plan and conduct interstate, interlocal, and regional solid waste disposal programs, and uniform state and local laws governing this area.

REFUSE ACT of 1899

§ 407. Deposit of refuse in navigable waters generally

It shall not be lawful to throw, discharge, or deposit, or cause, suffer, or procure to be thrown, discharged, or deposited either from or out of any ship, barge, or other floating craft of any kind, or from the shore, wharf, manufacturing establishment, or mill of any kind, any refuse matter of any kind or description whatever other than that flowing from streets and sewers and passing therefrom in a liquid state, into any navigable water of the United States, or into any tributary of any navigable water from which the same shall float or be washed into such navigable water; and it shall not be lawful to deposit, or cause, suffer, or procure to be deposited material of any kind in any place on the bank of any navigable water, or on the bank of any tributary of any navigable water, where the same shall be liable to be washed into such navigable water, either by ordinary or high tides, or by storms or floods, or otherwise, whereby navigation shall or may be impeded or obstructed: **Provided,** that nothing herein contained shall extend to, apply to, or prohibit the operations in connection with the improvement of navigable waters or construction of public works, considered necessary and proper by the United States officers supervising such improvement or public work: **and provided further**, That the Secretary of the Army, whenever in the judgement of the Chief of Engineers anchorage and navigation will not be injured thereby, may permit the deposit of any material above mentioned in navigable waters, within limits to be defined and under conditions to be prescribed by him, provided application is made to him prior to depositing such material; and whenever any permit is so granted the conditions thereof shall be strictly complied with, and any violation thereof shall be unlawful. Mar. 3, 1899, c. 425 § 13, 30 Stat. 1152.

—provides grants to state, interstate, municipal, and intermunicipal agencies and organizations for developing and revising solid waste disposal plans as part of regional environmental protection systems for such areas providing for recycling or recovery of materials from wastes and including planning for the reuse of solid waste disposal areas and studies of the effect and relationship of solid waste disposal practices on adjacent disposal sites.

—provides up to 75 percent technical and financial assistance to State and local governments and interstate agencies for

demonstrating resource systems and constructing new or improved solid waste disposal facilities.

—provides for the promulgation of guidelines for solid waste collection, transport, separation, recovery, and disposal systems as well as model ordinances and statutes.

—directs the Secretary to prepare a comprehensive report and plan for a system of national disposal sites for storing and disposing hazardous wastes which may endanger the public health or welfare.

The next major federal step in solid waste management was taken with the Executive Order which initiated the Environmental Protection Agency. EPA was begun in 1971 to reduce bureaucracy by combining the efforts of other federal agencies involved with environment. As part of its organization, it took over the duties and programs of the Bureau of Solid Waste Management that had been functioning since 1965 under the Department of Health, Education, and Welfare.

One of the programs initiated by EPA was the Mission 5000 Project, aimed at eliminating all open dumps throughout the country and replacing them with environmentally sound, non-polluting waste disposal methods. Other EPA programs deal with research and development of resource recovery projects, and the provision of planning funds through grants for solid waste systems.

Another significant bill for solid waste management became law in April, 1971. The Federal Occupational Safety and Health Act has been heralded as the most comprehensive safety and health measure ever enacted. It was designed to,"assure as far as possible every working man and woman in the nation safe and healthful working conditions and to preserve our human resources." Under this Act, each employer must furnish employment and places of employment free from recognized hazards causing, or likely to cause, death or serious physical harm and must comply with the safety and health standards promulgated under the Act.

To enforce this legislation, Federal inspectors are directed to survey places of business, job sites, shops, offices and may issue citations that carry immediate fines. Mandatory penalties may be imposed for each serious violation. Repeated violations may carry penalties up to $10,000. If a willful violation results in an employee death, upon conviction, a fine of not more than $10,000 or imprisonment for six months, or both may be imposed.

Further, employees may initiate requests for safety inspection; part of all of a business may be closed immediately if it is considered to be gravely dangerous; employers must keep and make available to the Labor Secretary and Health, Education and Welfare Secretary records on work-related deaths, injuries and illnesses; advance notice is not required before inspection; appeal of citation must be submitted in writing to the Area Director within 15 working days of employer's receipt of the proposed penalty; and programs for the education and training of employees and employers are to be conducted by the Secretary of Labor.

The major effect of this law on the waste management industry is in the area of operator safety. Equipment used in landfill operations must meet OSHA standards in compliance with schedules adopted by the Labor Department's Construction Safety Advisory Committee. In February 1972, the Committee adopted a schedule covering requirements for Roll-Over Protective Structures (ROPS) that involves retrofitting all earthmoving equipment, including new equipment.

STATE ROLE

Unquestionably the ever-growing public awareness and concern for protecting the environment has been dramatically reflected in the massive legislation of recent years. During 1972 alone, nearly 20 changes affecting the solid waste management industry were enacted through 16 legislative bills. Amendments and additions were made to the Codes for Health and Safety, Government, Fish and Game, Public Resources, and Revenue and Taxation.

Solid Waste Management and Resource Recovery Act of 1972

The Solid Waste Management and Resource Recovery Act of 1972, Senate Bill 5 created for the first time a State Solid Waste Management Board directed to develop and maintain statewide policy for solid waste management and resource recovery. Local government is still primarily responsible for solid waste management and planning.

The Board consists of seven appointive voting members with staggered two-, three-, and four-terms requiring senate confirmation. Five members, appointed by the Governor, include a City Councilman from a city of over 250,000 population, a county supervisor from a county with over 500,000 population, an environmental quality and pollution control expert, and two representatives from private solid waste management

PENDING LEGISLATION

There are many legislative proposals currently being considered at the Federal level that could affect the future state of the industry. Summaries of the major ones are described here.

RECYCLED MATERIALS

An amendment to the IRS Code of 1954 to provide a tax deduction for using recycled materials would offset the IRS depletion allowance now favoring use of virgin materials. This amendment would also allow a five-year amortization period for any solid waste recycling facility.

DISPOSAL TAXES

A proposal is being made to establish a National Solid Waste Management Commission which would set disposal taxes and a bond system. The taxes would be levied at the time of manufacture on selected products and materials. Purchasers would receive refunds for these products when delivered to a manufacturer, processor or designated disposal center.

NON-RETURNABLE CONTAINERS

Another proposed amendment to the IRS Code would impose a retailer's tax on certain nonreturnable containers. The tax would vary, depending on the size of nonreturnables from 10 cents for units under 20 ounces to 25 cents for containers equal to and greater than 20 ounces. For returnables, a tax ranging from 5 to 10 cents, depending on the size of the container, would be charged provided that the manufacturer of the item "has established a system with respect to the return of and reuse of recycling of the container" which meets the requirements established by the Environmental Protection Agency. The bill provides the taxes paid go to the municipalities where the containers are sold.

TOXIC AND HAZARDOUS WASTES

The Toxic Substances Control Act currently being proposed is intended to regulate interstate commerce by requiring premarket testing of new chemical substances and to provide for screening the results of the tests prior to commercial production. It also would require testing of certain existing chemicals and would authorize regulation of use and distribution of specific chamical compounds. In addition, the manufacturer of certain chemicals would be required to report periodically on the types, quantities and by-products from the production of these substances. One specific requirement of this legislation is the "description of the by-products, if any, resulting from the processing, use and disposal of these substances."

HAZARDOUS WASTES

The Environmental Protection Agency's Hazardous Wastes Management Act of 1973, introduced on March 6, would provide for the promulgation of federal regulations for certain hazardous wastes which, because of their quantity, concentration or chemical substances could, if allowed to be dispersed into the environment, result in substantial damage to human health or loss of human life. For wastes not subject to federal regulation, the EPA would be required to develop guidelines for state control of their treatment and disposal. Also included is a program of technical assistance to public and private institutions and a national research program related to the health and other effects of hazardous wastes.

CLASS ACTIONS

At least four proposals have been introduced which provide for citizen suits on actions related to environmental damage. The scope of this legislation varies in terms of the extension of rights of the citizen and the prerequisites for undertaking class action. On May 3, 1973 a three-judge U.S. Court of Appeals ruled in New York that a person who files a class-action suit must pay to notify each person on behalf of whom the suit was brought—even if it means notifying millions of people. If the decision stands, it could bring an end to mass class-action lawsuits.

OCCUPATIONAL SAFETY

Several legislative proposals have been introduced to amend the Occupational Safety and Health Act of 1970. One would provide for "consultative" visits by OSHA inspectors not permitted under the current act. Another would mandate OSHA to establish equipment required or action needed to be taken by small buisnesses to comply with the standards. Still another would provide that no penalty be assessed where violations to the Occupational Safety and Health Act of 1970 are corrected within the prescribed abatement period.

FEDERAL AGENCY PRACTICES

Several legislative bills have been introduced that would rquire federal agencies to use more products composed of recycled materials. These bills would expand the current policies of the Government Purchasing Office which specify the percentage of recycled paper required in paper products purchased by the government. They would apply to a broader range of products and a wider segment of governmental agencies.

industry—one from Southern California, the other from the northern part of the state. One member, an expert in natural resources, conservation and resources, is appointed by the Speaker of the Assembly. Another member, a registered civil engineer, is appointed by the Senate Committee on Rules. In addition, the Board has three ex-officio non-voting members— the Directors of Public Health, Agriculture, and Division of Mines and Geology.

To assist the Board in its widespread responsibilities, Senate Bill 5 created an Advisory Council. This council includes 25 voting members appointed by the Governor and confirmed by the Senate. In addition there are four ex-officio, non-voting members—the Directors of Public Health and Agriculture, State Geologist, and Chief Executive Officer of State Solid Waste Management Board. The Council is made up of a broad range of public and private solid waste handlers, public and private solid waste disposal facilities operators, major private industrial solid waste producers, agricultural and timber industries, representatives of citizen action solid waste resource recovery programs, a county supervisor, city councilman, local public health officer, and three representatives of the public-at-large.

The Council was created to help review the State Solid Waste Management Policy, review and make recommendations to the State Board on each regional or county solid waste management disposal plan, prepare and continuously review the State Solid Waste Resource Recovery Program, assist in the study of litter control and assist citizen-action groups and industries in resource recovery programs.

STATE SOLID WASTE MANAGEMENT POLICY

By January 1, 1975 the Board must adopt a policy setting minimum statewide standards for solid waste handling and disposal to protect the environment and public health, including recommendations for location, design, operation, maintenance, and ultimate reuse of solid waste processing or disposal facilities.

STATE SOLID WASTE RESOURCE RECOVERY PROGRAM

The Board must establish a Solid Waste Resource Recovery Program for the entire State by January 1, 1975. This program is to include special studies and demonstration projects on the recovery of useful energy and resources from solid wastes including methods of recovering resources and energy; identify potential markets for recovered resources; suggest changes in current product characteristics and packaging practices to reduce the amount of solid waste generated at its source; recommend methods of collection, reduction, separation, and containerization to utilize facilities more efficiently; show how State procurement could develop market demand for recovered resources; point out the effects of existing public policies including subsidies and economic incentives, disincentives; investigate advantages and disadvantages and methods of imposing disposal taxes on packaging containers, vehicles, and other manufactured goods; and encourage State pilot resources recovery projects.

COUNTY SOLID WASTE MANAGEMENT PLANS

Additionally, the Board is directed to:

- Approve comprehensive, coordinated regional or county solid waste management plans by January 1, 1976 prepared in accordance with adopted State Solid Waste Management Policy.
- Study and recommend alternative methods of providing financial assistance to local agencies for disposal facilities by July 1, 1974.
- Study the litter problem statewide and recommend methods of improving public education and incentives not to litter as well as improved methods of implementing existing litter laws by January 1, 1975.
- Study new or improved methods of solid waste handling, disposal, and resource recovery.
- Develop statewide solid waste management data system and public information program.
- Assist state and local agencies in planning and operating solid waste programs.
- Render annual progress reports to the Legislature, with the 1974 report containing special analysis of financial impact of proposed State Solid Waste Management Policy.

California Department of Public Health Bureau of Vector Control

The Department of Public Health, Bureau of Vector Control is primarily involved in waste management to assure public health by regulating operations and maintaining sanitary conditions. Through its responsibility for gathering solid waste management information on a statewide basis, the Bureau has emerged as one of the foremost stores of knowledge in this field in California.

Water Resources Control Board

Foremost in the effort to assure proper disposal practices in the State of California is the State Water Resources Control Board. This agency

through its Regional Boards, is a clearing house and focal point for other agencies. The State Water Resources Control Board was established by the 1967 legislature, and is divided into two statutory divisions—water rights and water quality. The State is divided into nine regions, each with a regional board authorized to adopt regional water quality control plans, prescribe waste discharge requirements, and perform other functions concerning water quality control. Four boards are active in the Bay Region. Board Number 2 serves nearly the entire San Francisco Bay Region, while Board Number 5 serves the Central Valley region from Sacramento extending into part of Solano County. Board Number 1 serves the northern portion of Sonoma County north of Santa Rosa and Board 3 serves South Santa Clara County.

The duties of the Boards are clear. In a directive dated March 2, 1972, Subchapter 15 of the State Administrative Code explicitly sets the course of Regional Boards:

> "Regional water quality control boards are required to adopt more stringent standards where local geological or hydrological conditions justify additional safeguards for the protection of the quality of ground or surface waters. Provision is made for waiving the report of discharge, approval and classification of sites, or establishment of waste discharge requirements in those cases where compliance with control measures of other agencies adequately protect water quality. New or expanded sites must have waste discharge requirements prior to use. Existing sites for which requirements have not been prescribed shall notify appropriate regional boards prior to July 1, 1972 Operating records are required for disposal sites where hazardous materials are handled."

The Board has adopted classification systems for disposal sites and wastes. Disposal sites are categorized as Class I, II-1, II-2, and III on the basis of their ability to protect the quality of nearby ground and surface waters. Class I, the most stringent, provides complete protection for water and public and wildlife resources and can accept all wastes. Wastes are ranked as Group 1, 2, and 3 in relation to their potential for causing pollution. In general, Group 1 wastes are from municipal, industrial, and agricultural sources and contain toxic substances which could significantly impair the quality of usable waters. Group 2 wastes—basically garbage, rubbish, construction, and demolition materials, street refuse, sewage treatment residue—is chemically biologically decomposable material compared to Group 3 wastes which are water insoluble, nondecomposable inert solids. This classification system is well suited to California and other states are beginning to pattern their systems on it. It provides all parties concerned with fundamental and consistent information regarding waste disposal sites.

*A complete description of Landfill Wastes Groupings and Waste Disposal Sites Classifications is presented on Page 115.

REGIONAL ROLE

Bay Area Air Pollution Control District

Another major agency responsible for control of waste disposal sites is the Bay Area Air Pollution Control District. The BAAPCD, created by the California Legislature in 1955, was the first of its kind in California. It encompasses the nine Bay Area counties except for northern Sonoma and northeastern Solano Counties with jurisdiction limited to stationary sources but including rail and sea transport. The District has the broad power to abate the emission of air contaminants that cause ". . . injury, detriment, nuisance or annoyance to any considerable number of persons . . . or which cause . . . injury or damage to business or property." (H & S Code-Sec. 24360)

The enforcement capabilities of the District are impressive. Over one half of its manpower is assigned to the enforcement division. Violations of Regulation 1, Open Burning, if deliberate, may be treated as misdemeanors. Violators are subject up to $500 per day fines or six months in jail or both.

The District may also seek an abatement order for violations instructing the Party to take specified actions to cease violations or to shut down operations. If the violation continues, civil penalties of up to $6,000 per day are possible.

San Francisco Bay Conservation and Development Commission

In response to widespread public concern over the filling of San Francisco Bay, the California Legislature in 1965, through the passage of the McAteer-Petris Act, created the San Francisco Bay Conservation and Development Commission (BCDC). The Legislature, which made the Commission a permanent agency in 1969, assigned it three major responsibilities:

- To regulate all filling and dredging in San Francisco Bay,
- To have limited jurisdiction over substantial developments within a 100-foot strip inland from the Bay to ensure maximum public access to the Bay and to reserve suitable shoreline property for ports, and water-related industry and recreation, and

- To have limited jurisdiction over any proposed filling of salt ponds or managed wetlands and, if development is authorized, to ensure that it will allow public access to the Bay and retain the maximum amount of water surface.

For the solid waste management industry, the effect of the Commission has been to virtually eliminate all Bay fill with solid waste.

LOCAL ROLE

In the San Francisco Bay Area, refuse collection and disposal is generally regulated at the county and municipal level. Almost all of the incorporated cities in the Bay Area have ordinances regulating refuse collection and transportation, and in some cases, disposal. Some communities are covered by ordinances adopted by a sanitary district.

Approximately 67 percent of the municipalities with ordinances make it mandatory for residents to subscribe to the garbage collection service. In July 1972 the City and County of San Francisco adopted an ordinance which places the ultimmate legal responsibility on an owner to pay for refuse collection if a tenant defaults in payment. In effect this is a more stringent regulation than other ordinances which only require mandatory subscription which can be cut-off by nonpayment.

Generally, cities rely on the county health department to enforce the sanitation sections of ordinances, although the police department and public works department or other city officials are sometimes responsible for enforcement.

ROLE OF PRIVATE INDUSTRY

As government and private industry have worked together to get rubbish from the source to the disposal site, it has generally been the private sector that has had the primary responsibility for the actual service and disposal process.

Strong evidence points to a growing trend for cities and counties across the nation to contract or franchise their disposal services. As far back as 1964, a survey conducted by the American Public Works Association showed that 225 cities had waste service contracts with private companies. Cities such as San Francisco, Seattle, Omaha, San Jose, Oakland, Minneapolis, Milwaukee, and numerous others provide residents with waste services in this way. Most cities which do operate their own collection systems generally relegate all multi-family housing of five or more units to private collectors. Many communities use a combination of public administration and private enterprise to handle their programs.

The franchise or license system which prevails throughout most of Northern California dates from the division of San Francisco into two collection areas. Franchises are awarded by cities for periods usually ranging from three to ten years with renewable options. This arrangment allows companies to plan more effectively for equipment purchase and disposal site acquisition since there is a high-risk for these capital outlays.

Under the franchise arrangement the collection company is strictly controlled in the rates it can charge by a city review board. Rate increases are allowed only when the company can demonstrate sufficient justification. In areas of the country where cities do not use franchise agreements, many companies offer their services directly to customers. This practice results in inefficient collection patterns and irregular service with no one company directly responsible for complaints about litter or uncollected trash.

Private involvement with solid waste goes far beyond collecting refuse. In the Bay Area, private industry is using San Francisco's waste to provide the City of Mountain View with much-needed recreational area and open space. The distance between these cities has required a transfer station where waste is processed before being loaded into larger-capacity trucks for the haul to Mountain View. This station was developed and is owned and operated by Solid Waste Engineering & Transfer Systems (SWETS) a private partnership of four firms.

Experience is proving, in fact, that many of the techniques and much of the equipment, developed by private industry for handling large volumes of solid waste generated by commercial and industrial accounts can be applied to municipal collection, processing, transferring, and disposal. Increasingly, in recent years, private expertise is being sought in government circles to hammer out solutions to solid waste problems. Two members of the State Solid Waste Management Board must be representatives from private industry—one from Southern California, the other from Northern California. Moreover, the 25-member Advisory Council assisting the Board must include, among others, a broad range of public and private solid waste handlers, disposal facilities operators, and industrial solid waste producers. Locally, in the Bay Area, two representatives from the California Refuse Removal Council are serving on a committee formed by the Hospital Council of Northern California and the San Francisco Bay Area Health Association to develop new ways to handle hospital and medical clinic wastes.

The greater use of private enterprise has been advocated by various organizations and publications. The National Academy of Science—National Academy of Engineering in its publication, **Policies for Solid Wastes Management,** observes that the time has come for greater participation of the private sector in solving solid wastes management. Another Organization, the National Association of Counties Research Foundation (NACOFR), has published ten guidelines on the organization of sold wastes management systems. The NACORF report is quite clear in its position that..."When private enterprise is available to do the job and can do so better and more cheaply, local government should limite its activity to regulation. Also, a recent publication by the League of Women Voters, **Solid Wastes . . . It Won't Go Away,** makes the point that ..."Small cities can sometimes ally themselves with a large contract system serving several cities and in some urban areas, the large, well-operated company can provide better service, maintain better working conditions, and offer better salaries than the public agencies." FORTUNE Magazine, also points to solid wastes management as an ideal example of how cities could improve their service and lower costs by stimulating a greater involvement of private enterprise.

In trying to organize and regionalize their solid waste programs, cities and political jurisdictions face many problems which often stagnate plans. These problems can be avoided, or at least minimized, by continuing to use the contract mechanism with private companies. With this approach private firms can take the initiative for planning, financing, and operating a regional solid waste facility with the role of local cities limited to approving the financial vehicle and contracting with the private firm.

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THE SOLID WASTE PROCESS

When a person takes out his trash for collection the next morning, his can, and the others he sees on the street, are only the tip of the solid waste process iceberg. They represent only a small fraction of the 14,000 tons of refuse collected every day in the Bay Area. Added up over a period of a year all this refuse amounts to 5 million tons which must be collected, stored, transported and transferred, processed for resource recovery, and, finally, disposed. Waste travels a long way from the back door trash can to its last resting place.

TYPES OF WASTE

Almost every activity of man produces waste—what he considers useless or unwanted and throws away. It is what we commonly call refuse or trash or rubbish. When it is mostly food wastes from kitchens and markets we call it garbage. Waste is designated as "solid" when it does not have enough liquid to be free-flowing. It can be categorized as municipal, industrial, and agricultural. Municipal wastes generally include household refuse; leaves, tree trimmings, and lawn clippings; commercial wastes from markets, airports, and office buildings; and demolition and construction trash. Industrial wastes come from lumber, manufacturing, chemical, and petroleum industries. And agricultural wastes are produced from livestock and vegetable- and fruit-growing operations. In California, municipal waste accounts for approximately one-third of the total production of waste compared to industrial waste which is less than one-fifth and agricultural waste which contributes nearly 50 percent. According to Oakland Scavenger Company studies, waste from East Bay cities is made up of: mixed garbage 42-49%; residential rubbish 29-30%; and commercial and industrial 23-29%.

CALIFORNIA WASTE PRODUCTION SOURCES

MUNICIPAL 32%	
Residential	Demolition
Commercial	Construction
	Special
INDUSTRIAL 19%	
Food Processing	Petroleum Industry
Lumber Industry	Manufacturing
AGRICULTURAL 49%	
	Fruit & Nut Crop
Livestock	Field & Row Crop

Source: CALIFORNIA DEPARTMENT OF PUBLIC HEALTH

The daily waste produced by a highly industrialized, urbanized civilization is staggering . . . consumer goods packaging, bundles of tree trimmings and yard clippings, plant prunings, old furniture, restaurant waste, trash from stores, hospital refuse, street sweepings, abandoned cars, dead animals, food processing leftovers, metal shavings, demolition and construction debris, sewage treatment residue . . . like the flow of refuse, the list is apparently endless. A concise summary, reproduced here from the American Public Works Association, defines the types of waste by kind, composition, and most probable source.

The importance of knowing what is in wastes is obvious. Handling and processing facilities must not only cope with the usual trash but must be prepared for many surprises such as automobile drive shafts, anvils, concrete foundation sections and the like.

In 1971 the Sunset Scavenger Company conducted a detailed sorting program to find out what was in the waste they had been collecting for so many years. Three different socio-economic sections of San Francisco were chosen as test areas. After sifting through literally thousands of pounds of residential waste, 11 categories were established. With slight variation due to socio-economic origin, the results showed that about 30 percent of the waste had a marketable value as paper, metal, or glass. This left a residue of 70 percent which was unmarketable. The Scavenger's study analyzed only residential waste and did not include other municipal or industrial wastes. Continued monitoring of the waste generated in San Francisco indicates that residential waste accounts for only about one half of the City's total waste.

REFUSE MATERIALS BY KIND, COMPOSITION, AND SOURCES

KIND		COMPOSITION	SOURCES
Refuse	Garbage	Wastes from preparation, cooking, and serving of food; market wastes; wastes from handling, storage, and sale of produce	Households, restaurants, institutions, stores, markets
	Rubbish	Combustible: paper, cartons, boxes, barrels, wood, excelsior, tree branches, yard trimmings, wood furniture, bedding, dunnage	
		Noncombustible: metals, tin cans, metal furniture, dirt, glass, crockery, minerals	
	Ashes	Residue from fires used for cooking and heating and from on-site incineration	
	Street Refuse	Sweepings, dirt, leaves, catch basin dirt, contents of litter receptacles	Streets, sidewalks, alleys, vacant lots
	Dead Animals	Cats, dogs, horses, cows	
	Abandoned Vehicles	Unwanted cars and trucks left on public property	
	Industrial Wastes	Food processing wastes, boiler house cinders, lumber scraps, metal scraps, shavings	Factories, power plants
	Demolition Wastes	Lumber, pipes, brick, masonry, and other construction materials from razed buildings and other structures	Demolition sites to be used for new buildings, renewal projects, expressways
	Construction Wastes	Scrap lumber, pipe, other construction materials	New constructions, remodeling
	Special Wastes	Hazardous solids and liquids: explosives, pathological wastes, radioactive materials	Households, hotels, hospitals, institutions, stores, industry
	Sewage Treatment Residue	Solids from coarse screening and from grit chambers; septic tank sludge	Sewage treatment plants; septic tanks

Source: AMERICAN PUBLIC WORKS ASSOCIATION

Test Analysis of Urban Refuse In San Francisco

Nature of Collections	TEST AREAS					
	PARK MERCED		RICHMOND DISTRICT		VISITACION VALLEY	
	WEIGHT	PERCENT	WEIGHT	PERCENT	WEIGHT	PERCENT
Recoverable newsprint	203 lbs*	10.15	126 lbs*	6.30	144 lbs*	7.20
Recoverable corrugated	36 lbs*	1.80	48 lbs*	2.40	29 lbs*	1.45
Recoverable plastics (pure)	44 lbs	2.20	37 lbs	1.85	41 lbs	2.05
Rags, all clothes, etc.	42 lbs	2.10	56 lbs	2.80	65 lbs	3.30
Metals, all ferrous bi-metal, aluminum, etc.	176 lbs*	8.80	187 lbs	9.35	168 lbs*	8.40
Glass, all	269 lbs*	13.45	242 lbs	12.10	242 lbs*	12.10
Dirt, plaster, grass, etc.	54 lbs	2.70	61 lbs	3.05	24 lbs	1.20
Putrescibles (wet refuse)	76 lbs	3.80	104 lbs	5.20	91 lbs	4.55
Mixed paper wastes	836 lbs	41.80	740 lbs	37.00	724 lbs	36.20
Leather (shoes, etc.)	16 lbs	.80	18 lbs	.90	7 lbs	.35
Other (small indifferent materials, mixed plastic & fibre combinations	248 lbs	12.40	381 lbs	19.05	464 lbs	23.20
Total	**2,000 lbs**	**100.00**	**2,000 lbs**	**100.00**	**2,000 lbs**	**100.00**
**Marketable or saleable materials*	684 lbs	34.20	603 lbs	30.15	583 lbs	29.15
Matter requiring disposal	1,316 lbs	65.80	1,397 lbs	69.85	1,427 lbs	70.85

Source: SUNSET SCAVENGER COMPANY

Special Wastes

Hazardous wastes pose special problems. They can be toxic, corrosive, highly flammable, volatile, explosive, irritating or strongly sensitizing, capable of causing personal injury or illness. Some of these substances include outdated or off-grade chemicals or chemical solutions such as caustics, acids, or solvents; contaminated paper, cloth, or wood; slurries containing heavy metal ions; or toxic organics and industrial sludges from tank bottoms with oily residues.

For the same reasons, hospital and medical clinic wastes require special handling. Medical facilities are using an ever-increasing number of disposable items including sheets, gowns, and other linens, and even utensils. These are being added to other common medical wastes—sharp needles, pathological and surgical remains, non-combustibles, ashes and residues, kitchen garbage, radiological refuse, and animal carcasses.

Many of these materials are incinerated under a special variance provided by the Bay Area Air Pollution Control District. Another portion goes into the sewerage system. But most of these wastes are collected and disposed in landfills.

In 1973 the Hospital Council of Northern California and the San Francisco Bay Area Health Association formed a committee to cope with this problem. The California Refuse Removal Council will have two representatives on the board—one for collection concerns, the other for disposal activities. The conclusions and recommendations of this group should represent the most current thinking and provide practical solutions which hospitals can adopt on a widespread basis.

Bay Area canneries, mostly located in Alameda and Santa Clara Counties, produce other special wastes. Until recently barges hauled much of it through the Golden Gate to dump it at sea. Some is spread without controls in the fields. Recent research has produced improved methods of applying cannery wastes to land.

Sewage sludge presents yet another disposal problem. Sludge, the solid matter separated from sewage is applied to land. Officials estimate that Bay Area cities produce 1,000 to 1,500 tons of sludge every day. And this amount is increasing as the Regional Water Quality Control Board and the Environmental Protection Agency impose increasingly stringent regulations on discharges to the Bay. In effect, these regulations reduce the amount of sewage discharged to the Bay and create correspondingly greater amounts of sludge.

COLLECTION TRUCKS

The most common vehicle in service in the Bay Area is the 20-cubic yard rear-loading packer truck. Mounted on a cab-over chassis, this versatile combination provides maneuverability, a large receiving hopper, and, with special attachments, can lift one-to three-cubic yard containers. Normal loads in this truck range between five and seven tons.

Slightly larger is the 25-cubic yard packer truck. Although it is not as maneuverable in downtown areas, in alleys and between parked cars, it works better in residential areas with wide streets. It features many of the same accessories as the smaller truck and can pack between eight and ten tons.

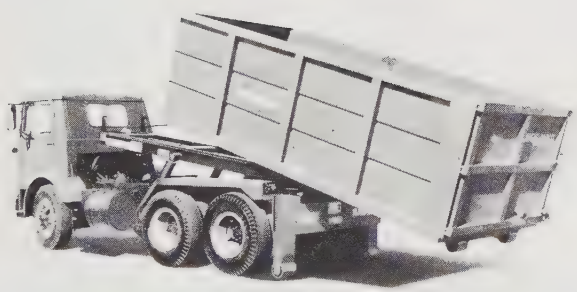
Also used on residential routes is the side-loading compaction truck. These trucks feature a loading hopper directly behind the cab and have right-side drive for easy curb access. They are often used with a one-man crew on curbside pick-up route.

Front-end loading trucks ranging from 25 to 40 cubic yards are used predominantly for commercial and industrial plants. Containers with 2-to 12-cubic yard capacity can be lifted over the cab and into the top of the compaction body.

Larger accounts are serviced by piggy back trucks with tilt-bed frames using special roll-off systems to pull large refuse containers onto the truck with winch and cable. These trucks are also used for construction and remodeling jobs. Boxes are usually from 20 to 30 cubic yards but can be handled up to 40 cubic yards. Usually waste material is loose but manufacturers now provide boxes that work with stationary compactors to make more efficient use of the container.

COLLECTION

Collection is the first step in getting rid of garbage and trash. In the nine Bay Area Counties about 80 companies collect over 4 million tons a year of municipal and industrial refuse from many sources—homes, apartments, stores, high-rise office buildings, hospitals, and manufacturing plants. In addition, nearly a million tons annually is hauled directly to disposal sites by industry, demolition crews, and the general public.



Because the collection process is nearly 60 percent labor-oriented, it represents the major expense in waste management. In the Bay Area, over $100 million was spent on collection in 1972. This represents approximately 80 percent of the total cost with the remaining 20 percent spent for transfer, processing, and disposal.

Problems arise right here at the beginning of the waste removal process. In most cities collection times are restricted by ordinance. Usually residential collection cannot begin before 7 a.m. But in other areas, such as downtown districts, collection trucks must be finished by 6 a.m. to make way for the daytime traffic influx. To do this, many of the Golden Gate Disposal Company's routes begin at 11 p.m. in San Francisco's financial district. Similar timing is necessary in downtown Oakland.

Noise from trucks is an annoyance to residents and workers alike. Increasing noise pollution has prompted cities to impose maximum decibel levels to help control annoying irritating sounds. A recent improvement now on the market reduces the noise level during the packing cycle on collection trucks. This device—a quiet pump—can be fitted to most truck units and greatly reduces noise levels.

Hospitals and medical building waste collection can be hazardous. In scattered instances, scavengers have contracted hepatitis after being pricked by needles hidden in the waste. Handling these wastes requires more regulation and standardization.

Standardizing residential containers to mechanize collection seems nearly impossible although it is being tested. The City of Scottsdale, Arizona for example, has developed a standard container shared by four households. As the collection truck moves along a street, a long extension arm lifts the container, empties it into the truck, and returns it to the curb. But this device is restricted to well-planned and designed residential areas with curbside collection and requires participation from everyone on the route. To apply this method in the Bay Area would require the same conditions. In San Francisco, with its narrow streets, steep hills, and impossible parking situation, mechanized collection is only a remote possibility.

BAY AREA REFUSE COLLECTION

Bay Area refuse is collected once a week as required by city and county ordinance. And, as a deterrent to heavy fly production from garbage cans, some cities even require twice weekly collection during the summer months. In two thirds of Bay Area cities, subscription to garbage collection service is mandatory. Refuse collection is regulated by county ordinance and regulation, cities, and the State through the Health and Safety Code. Generally the counties supervise the sanitary refuse removal activities and cities usually rely on county health departments to enforce the public health aspects of collection and disposal.

Virtually all refuse collection in the San Francisco Bay Area is done by private companies except for Berkeley, San Leandro, and Dixon which maintain municipal collection departments. Most of these companies operate under exclusive franchises or contracts issued by cities, sanitary districts, or counties although a few unfranchised collectors are allowed to operate in some unincorporated areas. Some cities issue franchises only for household garbage and open commercial pickup to competition. Licenses or permits are required by all the counties and incorporated cities for collectors to operate within their jurisdiction.

Most collection agencies operate within specified areas. The area boundaries are usually determined by economic considerations, political lines, agreement between collectors, or by an association of collection companies. In Contra Costa County, for example, the Western Disposal Operators' Association established general collection areas through agreement between its members.

STORAGE CONTAINERS

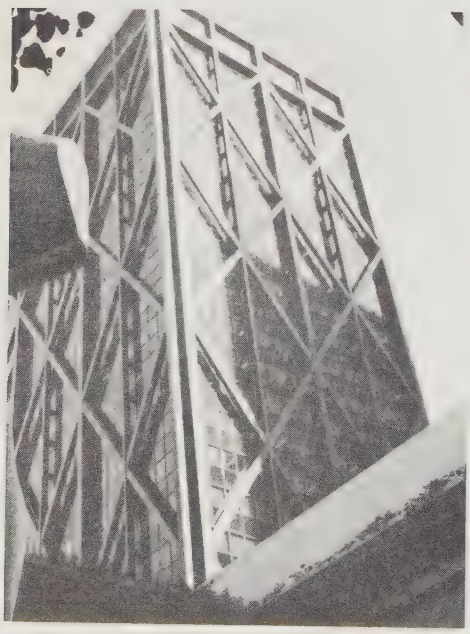
Proper storage containers are important to efficient collection. Containers come in all shapes and sizes and have as many functions.

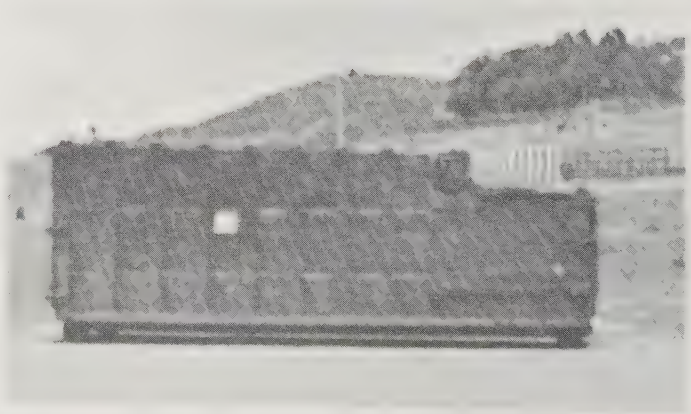
Most common on residential routes is the 30-gallon garbage can, usually metal but sometimes of durable plastic. Some cities with curbside service are using plastic or paper bags on residential routes for quicker on-the-move service.

Other containers used are 1-and 2-yard boxes found in apartment buildings and commercial places such as gas stations, restaurants, offices, and medical buildings. These containers are fitted with hinged lids and rubber wheels and can be dumped into the rear hopper of a standard rear packer truck or into the top of a front loader.

Still other container types are used where large amounts of refuse collect. In large hotels, stores, manufacturing plants, hospitals, airports, racetracks, and high-rise office buildings, a stationary compactor is often installed. These compactors use floor space more efficiently and require less frequent collection. Stationary compactors range in size from 20 to 40 cubic yards and will usually pack 4 to 8 tons of waste.

Another container used is the open roll-off or piggy-back. This, too, has a 20-to 40-cubic yard capacity and is frequently used in construction jobs, manufacturing plants, stores, and for special jobs.





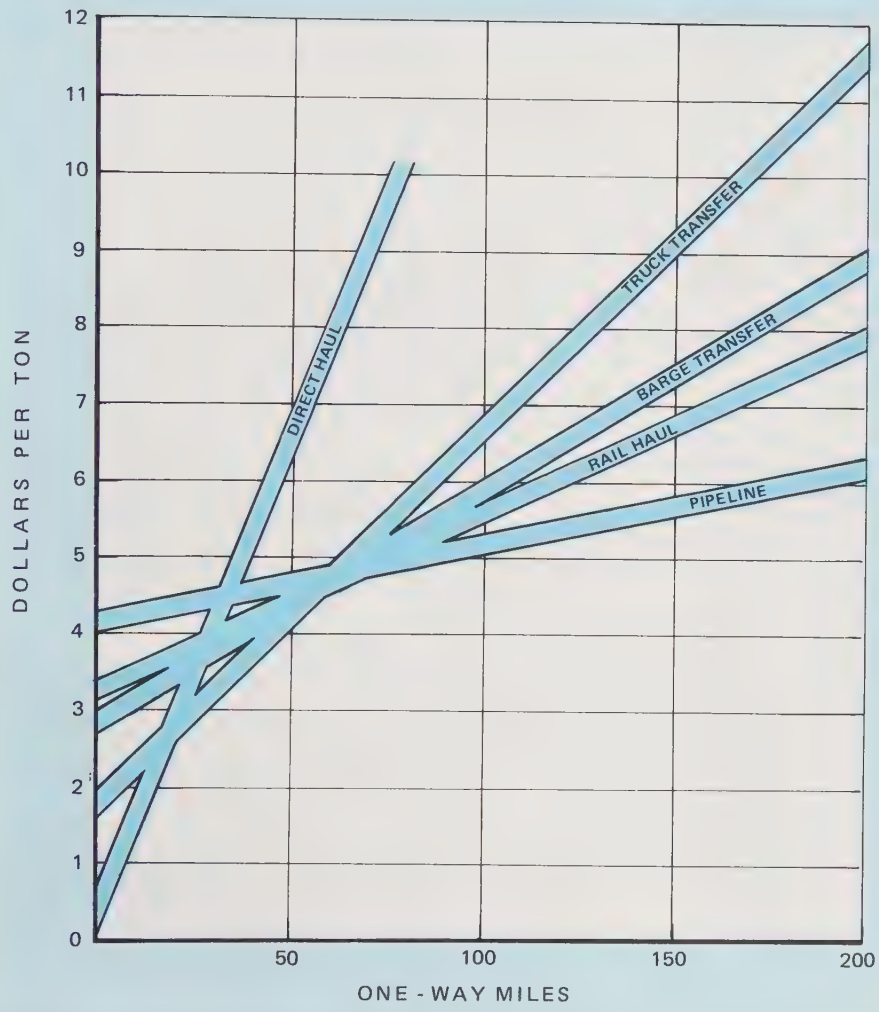
SELF CONTAINED COMPACTORS SOMETIMES USED IN HIGH RISE BUILDINGS

TRANSFER AND TRANSPORT

After wastes are collected, they must be moved to the final disposal site or processing facility. The need for close-in disposal sites is obvious—the shorter the haul, the lower the transportation costs. But, as high-density growth patterns have caused property values to soar, sites with sufficient area for sanitary landfill operations have become scarce. Future sites will be even further away from where waste originates.

Increased distances demand more efficient transportation methods. When landfill sites are close to metropolitan areas, direct haul by collection truck is usually most economical. For example, a typical 20-cubic yard packer truck with a two-man crew has an economical haul range of about 20 miles each way. But beyond that, especially for service areas with over 100,000 population, it is usually cheaper to haul wastes to nearby transfer centers and collect the contents of many trucks in vehicles with larger carrying capacities for hauling to outlying disposal sites. Although transfer operations normally require large tonnages of waste to compete with direct haul operations, there are some small compaction transfer stations, such as the one in San Bruno, processing less than 100 tons a day.

Conventional transportation systems use trucks, railroads, barges, or pipelines. Each has been used for solid waste transfer at one time or another. But, economics have made truck transfer predominant and, in the Bay Area, it is the only system now used for waste hauling. Long-haul trucking economics are directly related to vehicle carrying capacity. With current industry costs about $23 an hour for drivers, truck amortization, fuel, tires, and maintenance, capacity is critical.



TRANSFER and HAUL COST

Shown here are many transfer systems and how they relate to each other. Distance is the variable which makes one system more competitive than another. For example, direct haul is economical to approximately 20 miles one way. From 20 to 70 miles, truck transfer is least costly. Beyond that distance, rail haul offers the most economical means of transfer, or barges can be considered if the final destination is near a water course. System lines start at different points on the vertical scale because initial preparation and transfer costs vary for each system.

Source: EASLEY & BRASSY CORP.

A new means of waste transfer, high-density baling, is being demonstrated in two places in the United States. In St. Paul, Minnesota, 3000-pound bales of waste about 3'x3'x4' are being produced every two minutes and loaded onto a semi-trailer for the 11-mile trip to the landfill. In San Diego, California, similar bales, 3'x3'x5' weighing about 2600 pounds are produced after a shredding process and are hauled about a half mile to a small canyon site.

A long-distance alternative, rail haul, is usually considered competitive with trucks when the distance to the disposal site is over 70 miles. Waste can be hauled loose in covered gondola cars on containers, or baled first and stacked on flat cars or in box cars. In the 1930's, San Francisco had a rail haul operation and it nearly became a reality again in the late 1960's. The recent proposal would have hauled waste 375 miles to a landfill site in Lassen County, California.

Barging by its nature is limited to cities adjacent to waterways. The major waste barge transfer operation in the country is in New York City where waste is directly dumped into open barges. Seattle also uses barging for a small part of its waste. In the Bay Area, barging has been used for cannery waste and dredging spoils. Recent schemes have suggested containerizing waste for barging operations.

Pipelines are used to transport high volumes of material from fixed point to fixed point over many years. Conventional examples include gas and oil pipelines, water and storm drains, and mineral pipelines such as those used for coal. Some recent study and investigation into the use of pipelines for long-distance transport of solid waste has shown very limited application. The economics of the system require extremely large quantities of waste—on the order of 10,000 tons per day—for point-to-point delivery.

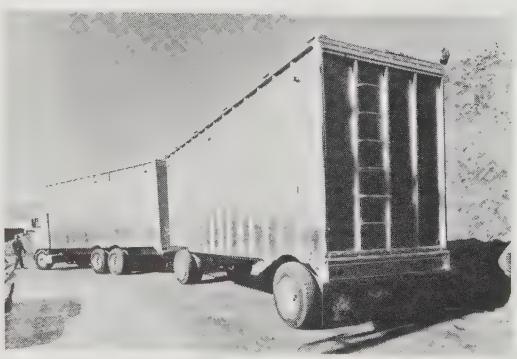
Short-distance vacuum installations are now being used for collection in the United States. Adopting the Swedish design originally used in apartment buildings and hospitals, a New York apartment and a Los Angeles hospital have each installed the system. The new Kaiser hospital in Vallejo will also use it. A more recent adaptation of the Swedish model for one-building use expands the concept to an urban scale. In Walt Disney World in Florida an undergound pneumatic tube system uses 15 stations throughout the park where trash is brought after being collected in conventional containers. Attendants drop the bags into a chute where the waste is whisked away at 60 mph through a 20-inch diameter pipeline to a compaction plant.

TRANSFER TRUCKS

To make long-distance hauls economical, transfer trucks must, of necessity, carry considerably more payload than collection trucks. Moreover, because they do not have to maneuver city streets and alleys, transfer trucks can also be larger in size to provide this capacity.

High-capacity truck and trailer units are capable of hauling 25 tons of waste per trip. These bulk units vary in size from 120 to 140 cubic yards and because they are loaded loosely by gravity, they can be built of aluminum to minimize dead weight. At the landfill, specialized tippers lift the entire truck to spill the waste out the rear door.

The compaction transfer truck varies in size from 65 to 75 cubic yards. These semi-trailers are made of heavily reinforced steel to resist the force of compaction ram and carry additional weight in hydraulic oil to activate the large ejector place. The resulting legal payload ranges from 16 to 19 tons.



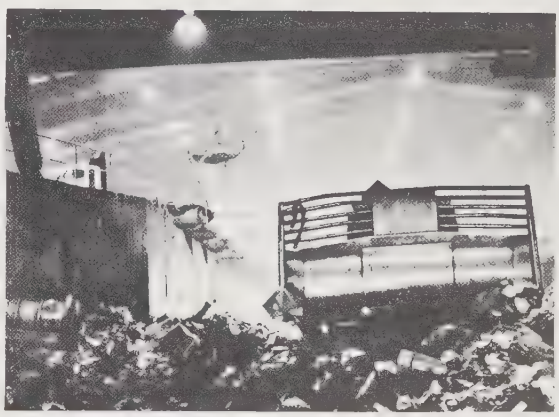
SOLID WASTE TRANSFER STATION SAN FRANCISCO

The largest transfer operation in the Bay Area is operated by Solid Waste Engineering and Transfer Systems. The operation, serving the City and County of San Francisco, is also open for public disposal. From this site, waste is hauled 32 miles south to the City of Mountain View where a 544-acre regional park is being built on sanitary landfill.

Over 2100 tons of waste a day are processed through this station five days a week. Automatic computerized scales speed the work by weighing all incoming loads and recording the tare, gross and net weights, time, date, and disposal fee. Other scales record similar data for outgoing transfer trucks. Nearly an acre of floor space in the transfer building accomodates more than 100 trucks per hour at peak periods.

As incoming collection trucks unload into a large pit two Caterpiller D-8 tractors run over the waste, breaking and smashing large bulky items such as lumber, refrigerators, and sofas. The "Cats" then push the waste to the tunnel area where transfer trucks are loaded. After loading—which takes about six minutes—a hydraulic pedestal-mounted clambucket distributes the load on the axles to ensure a load of 25 tons equal to legal highway loading.

The 32-mile trip to the Mountain View landfill takes over half an hour on the Bayshore Freeway. Once there, the truck unit backs onto two specialized unloading mobile tippers that separately tip the truck, then the trailer, about 45 degrees to spill the waste from the rear door. Tractors and landfill compactors that build the sanitary fill take over the job from there.



RESOURCE RECOVERY

Recycling is not a new concept. Bay Area scavenger companies recycled for years when there were substantial markets for bottles, rags, metal, and paper. But investments in bottle washing plants were wiped out with the advent of the one-way bottle. And with the arrival of synthetic fabrics as a major replacement for cotton, ragpicking as a form of recycling virtually ended.

Today salvage efforts are continuing. The major collections are newsprint and corrugated papers. Newpapers are baled and sold to paper companies and used in making corrugated cartons or de-inked chemically and used directly as newprint again. But it is a highly unstable market and a sudden influx of old newsprint drives prices down filling scavenger warehouses with worthless paper. A more reliable, though small, market exists for corrugated paper. And the market for mixed paper from offices and institutions is also fairly stable and insignificant with consumption of roofing felt, tablet backs, and shoe boxes at consistently low levels.

Yet the need to preserve our natural resources becomes clearer every day. Power brownouts and fuel shortages have recently hit the Bay Area during its coldest period in years. New home appliances, convenience products, and elaborate packaging have increased demands on energy and resource reserves available to the United States. These are a direct result of American affluence and wasteful consumer attitudes.

In fact, few people realize what treasures lie buried at the city dump. Eight billion metal cans alone! Forty million tons of paper! Seven million old cars and trucks! At a time when America's natural resources are beginning to dwindle, recycling could help stem the demand for virgin materials. Moreover, the Environmental Protection Agency (EPA) reports that recycling processes cause less water and air pollution than processing virgin materials. And, reprocessing uses less energy. As an example, high-quality paper produced from recycled fibers instead of wood causes 15 percent less water pollution and 60 percent less air pollution. And, in the process, 60 percent less energy is consumed.

Despite the potential benefits, recycling has not yet begun to cope with the wealth hidden among the rubble of trash. Developing the technical capability to process and separate the usable and valuable items in the conglomerate has been a difficult and expensive task. Manual separation is no longer physically or economically feasible. With compactor collection trucks now in widespread use, it is not possible to hand sort the waste as scavenger companies did in the past.

Processing waste, that is, removing still-useful materials, requires equipment that has not been available from manufacturers until recently. Large shredders of 1000 horsepower or more, air classifiers still in the proving stages of development, upsurge water float equipment, vibrating screens, magnetic heads, and dense media separators each require special adaptation to an integrated system yet to be built. Conceptual designs and prototype models of recovery plants abound, but a full-scale production plant that recovers paper, ferrous metal, glass, aluminum and other non-ferrous scrap does not exist. And, even with the availability and use of this equipment, the major problem remains—the lack of markets to absorb materials once they have been rescued from oblivion.

Government participation in resource recovery operations has a relatively short history. With the passage of the Solid Waste Disposal Act of 1965, most of the federal effort was concentrated on developing new systems of waste disposal and handling. The 1970 Resource Recovery Act and the organization of the U.S. Environmental Protection Agency was the government's first major attempt in recent years to tackle the problem. But federal transportation economics still favoring the use of virgin rather than secondary materials cast some doubt on the sincerity of federal efforts on this front of environmental concern. Depletion allowances encouraging the production of oil and minerals further discourage and weaken recycling efforts.

Large-scale reclamation will require a more active responsible role by government in legislating more realistic rail rates for secondary scrap, and using government purchasing power to provide markets for recycled materials. Government aid would provide low-interest loans and tax exemptions for building recovery plants and fund projects that show promise of success.

Possibly, the most important factor will be the willingness of the public to cooperate and support—even demand—responsible programs that deal with resource recovery. The question is whether the public is willing to pay for the sophisticated recycling programs necessary to conserve natural resources, or if recent ecological concern has been mere rhetoric.

The final answer to recycling and resource management in the San Francisco Bay Area and throughout the country will incorporate many

ideas and plans including resource recovery, reduced consumer packaging, development of new markets and outlets for reclaimed materials, and legislative action.

RECYCLED MATERIALS/POST CONSUMER PRODUCTS

Post consumer products are one part of the recycling process. These are materials which have been used by consumers, discarded, then salvaged and reprocessed into new consumer products. Such items include, for example, soda pop and wine bottles, tin cans, and newspapers. Not included in this category are the materials re-used directly at the manufacturing stage—the trimmings and factory breakage—which are commonly included in the general definition of recycled goods.

Metals

Some recycled materials are in demand. Unlike paper which faces unstable or negligible markets, tin cans are sought for the copper mining industry of Arizona, Nevada, and New Mexico. The industry estimates the potential demand to be three to ten times greater than the present level of supply.

Hundreds of millions of scrap steel cans recovered from municipal waste are used as "precipitation iron" to extract copper from low-grade ore. It takes about three tons of steel cans, which are shredded and added to a chemical bath, to leach one ton of copper from the ground ore. Approximately 15 percent of U.S. copper is produced by this process. An estimated 18 billion scrap steel cans could be used in copper mining each year. The industry estimates the potential to be three to ten times greater than the present levels of supply.

Bay Area processing equipment is already operating to respond to this market. High-powered shredders working in two landfills—Davis Street in San Leandro and Acme Fill in Martinez—process residential waste and magnetically reclaim tin cans.

A similar method is used at the San Francisco transfer station. Here over 1000 tons a day of residential waste are conveyed to a 300-horsepower horizontal hammermill which breaks open bags and exposes tin cans. A conveyor carries the shredded waste to two counter-rotating magnetic drums that pull out the cans which are then loaded into large open-top vans and shipped to Sacramento for further processing. The system is privately financed and operated by Los Angeles By-Products Company which for years has been actively involved in mechanically "mining" solid waste from landfill sites throughout California and the Southwest.

Another market for tin cans is reclamation by detinning. Six million used steel cans are recycled annually by detinners. Tin recovered by detinning is the only domestic source of metal which otherwise must be imported at a cost of about $3,600 a ton. Electrolytically reclaimed tin is said to be purer than the material extracted from ore.

Used steel cans can also be recycled into new steel in basic oxygen furnace, open hearth or electric furnaces. More than a billion used cans will be recycled in steel-making furnaces this year. America's steel-making companies state that they will accept for remelting all the used steel and bi-metallic cans they get. Like all other steel scrap, cans must meet certain specifications in terms of cleanliness and density.

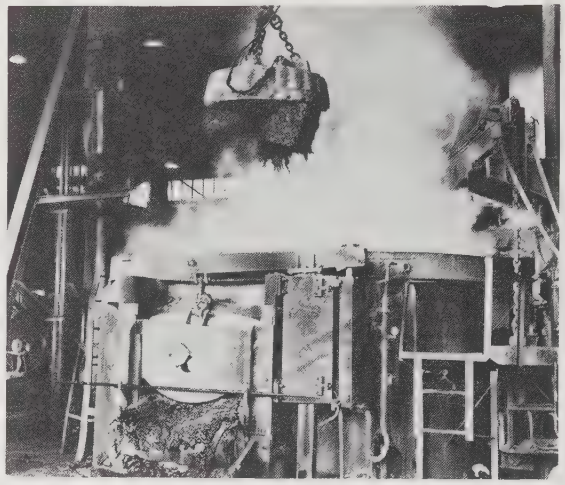
The Bureau of Mines, College Park, Maryland, has a method to reclaim metal from incineration residue. Metallic iron concentrates, non-ferrous metal, glass and ash are products of the system. Mineral and mining technology were employed and modified for this development work and a demonstration plant is scheduled to be built in Lowell, Massachusetts.

In San Francisco, Solid Waste Engineering & Transfer Systems is currently investigating the economic feasibility of adding a full-scale plant to the existing transfer station to recover aluminum, glass, copper, brass, zinc, and other non-ferrous metals. A series of shredding air classifiers and other processes will be used in the operation.

Glass

Glass containers are widely used in packaging foods, beverages, cosmetics, drugs and other products, and represent the largest individual segment of the overall glass industry. The principal raw materials for glass containers—essentially sand, soda ash, and limestone—are among the earth's most abundant raw materials and low in cost. In the Bay Area, the percentage of glass in residential waste—8 percent—is similar to the amount in other parts of the country. However, the noticeably higher amount of green glass is attributed to the popularity of wine.

The use of glass cullet for remanufacture into new glass containers is dependent on the ability to remove impurities and segregate the glass particles by color. Because cullet specifications are stringent and because of the difficulty and limitation in reprocessing the nation's waste as cullet, the Glass Container Manufacturers Institute developed new products manufactured from recovered glass. Some of these products are glass wall insulation, foamed glass wall panels, building blocks, tile, glasphalt, and terrazzo tile. None of these materials require color sorting. The remanufacture of recovered glass into new glass containers is ideal from the ecologist's point of view but economic realities may result in recovered glass used to develop many new products instead of reducing the need for virgin materials to manufacture products.



Paper

In the Bay Area final plans are being made to build a $30 million paper recycling plant. The plant to be built in Richmond is a venture of MacMillan Bloedel, Ltd. MacMillan is Canada's largest forest products company and one of the largest suppliers of newsprint on the west Coast. The plant will have an annual capacity to de-ink and reprocess about 100 thousand tons of newspaper. Supply for this high volume is the vital factor bearing on the decision to move ahead on the project. It is expected that scavenger companies will be an integral part of the project by collecting and hauling newspaper from the cities they serve. Demand will require used paper to be hauled from as far as Fresno and Reno.

In Franklin, Ohio, the Black Clawson Company has developed a wet process system for recovering paper pulp. The heart of the system is a hydrapulper, similar in design to a giant sink garbage disposer which received most types of municipal waste. The waste is mixed with water and pulped into a slurry and the recovered fiber is used in making roofing paper. At the same time, ferrous metal is recovered with a magnet. The plant has processed an average of 50 tons of waste a day since its opening in June 1971 and about 32 percent of this incoming waste is burned.

In Philadelphia, Pennsylvania, at the Franklin Institute, shredded refuse is screened and passed through a ballistic separation. Paper fiber is recovered from mixed refuse by using a dry process. A pilot plant was built in 1972 and tests began at that time.

WASTE DISPOSAL METHODS

The last step in any refuse process system is the final disposal of what remains after any useable materials have been salvaged. In the San Francisco Bay Area about 97 percent of the waste is disposed this way. But there are other ways to take care of residue remaining after resource recovery operations—incineration, pyrolysis, composting, and ocean disposal are the most important. Except for ocean dumping, a significant portion of the original volume treated by these other methods still depends on sanitary landfill for final disposal.

Many factors enter into the selection of a waste disposal method. What is feasible for one municipality may be unworkable for another. Environmental considerations, land availability, transportation expenses, investment and maintenance costs for sophisticated technology, and labor costs must be weighed in the final decision.

Sanitary Landfill

Sanitary landfill is a landfill method where refuse is deposited on flat land or in canyons, exhausted quarries or pits, compacted with heavy equipment, and covered with a layer of earth at the end of each day's operation.

Environmental protection is a major purpose of sanitary landfill. Waste is confined to a specific area, compacted, and covered daily to protect public health and safety.

In the San Francisco Bay Area, landfilling is used to dispose of 97 percent of the 14,000 tons of waste generated every day. A land disposal is the most versatile way to handle it. Any type of waste, regardless of size, weight, or origin can be disposed. Moreover, properly located sanitary landfills can safely dispose of hazardous and liquid industrial wastes without endangering the environment or public health.

Today, more than ever before, conservationists are alarmed at landfilling as a way of disposing of waste. But the Environmental Protection has noted that sanitary landfill is a necessary part of any waste management system. Even when other processes and reduction methods are used, the remaining residue will require a sanitary landfill.

RECREATION FROM SANITARY LANDFILL

Landfilling with waste has proven to be an environmentally and economically sound way to improve marginal land and restore its usefulness. There are a number of cities across the country that have converted once useless real estate into golf courses, outdoor amphitheatres, ski hills, and entire sports complexes.

For example, in the Bay Area, San Francisco refuse is being transferred to develop a 544-acre community park in Mountain View. The completed facility will have a 22-hole golf course, lakes, picnic grounds, swimming pools, tennis courts, and a small boat lake.

A lush, 87-acre botanical garden in Los Angeles has grown out of an old abandoned strip mine used for sanitary landfill. In addition, the entire 220-acre area will also be the location of an 18-hole golf course, little league ballfields, tennis courts, and riding stables with an 80-horse capacity.

In 1965, a sanitary operation in an 11-acre wasteland was started in Anoka, Minnesota. Ten years later, there were four tennis courts, three baseball fields, a football field, a small children's park, and ample automobile parking facilities for the entire community.

A student body of 3500 in Park Ridge, Illinois is housed in an attractive high school campus built on a site that once served local industry as a borrow pit for sand. Main Township High School was erected on a former 5-acre swamp through sanitary landfill.

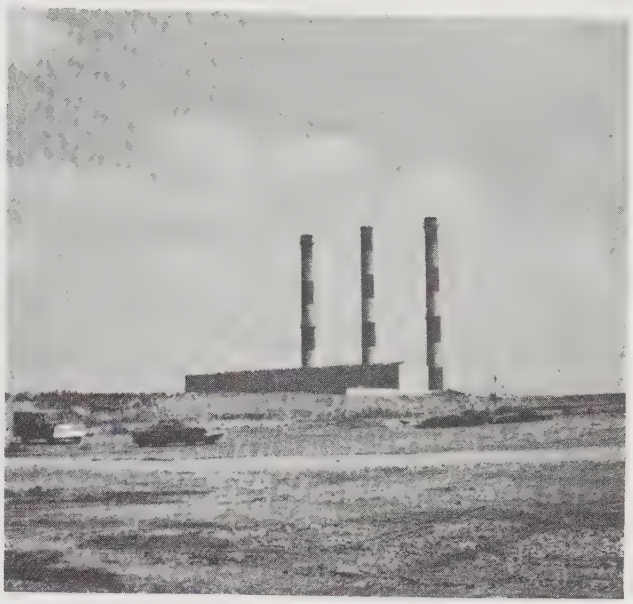
In Alton, Illinois 69 acres of sanitary landfill are being planned for a park and nature preserve. Lawn areas will be seeded with grass, and slopes planted with ivy. Already, quail, rabbits, squirrels, deer and song birds live safely in the preserve.

In Chicago, more than 100 acres, formerly a clay pit, now houses a prestigious apartment-condominium complex.

A 75-acre recreation and park complex is being built on sanitary landfill in Long Island, New York. The facility will house 16 tennis courts, 15 handball courts, four basketball courts, two football fields, six baseball fields, a 7,000-seat stadium and several swimming and wading pools. New trees will shade picnic places, leisure walks, and recreation areas.

In Oakland, the 18-hole Lew Gailbraith Municipal Golf Course was developed from fill placed by the Oakland Scavenger Company through the 1960's. Nearby along Doolittle Drive the Oakland Raiders Training Field was also built on rubbish fill.

Incineration



Incineration is currently the only large-scale alternative to landfill. The 1971 **Source Inventory of Air Pollutant Emmissions** indicates that, in the Bay Area, a total of 1400 tons a day of residential, commercial, forest, and agricultural wastes are being burned. Of this amount, about 450-500 tons of residential and commercial waste are burned in nearly 700 single or multiple chamber incinerators located in apartments, schools, hospitals, retail outlets or warehouses sprinkled throughout the area. This represents about one third of all waste burned and about 3 percent of total urban wastes disposed.

The primary advantage of requiring less land for fill operations is offset by cost disadvantages. Modern municipal incineration plants equipped with necessary air pollution control devices such as wet scrubbers and electrostatic precipitators are extremely costly to build and operate. With construction costs alone varying from $15,000 to $20,000 per ton of rated capacity, a plant designed to serve 300,000 people or burn 1000 tons per day could cost as much as $20 million. High costs are also incurred for operation and range from $9 to $16 per ton compared to $1.50 to $4 per ton for a sanitary landfill operation without incineration.

Even with sophisticated emission control equipment, incineration often produces particulate emissions above the atmospheric pollution levels allowed by the Bay Area Air Pollution Control District (BAAPCD) and the Environmental Protection Agency. And, as these agencies continue to adopt increasingly stringent criteria, incineration will have to become technically more refined to meet these stiff standards.

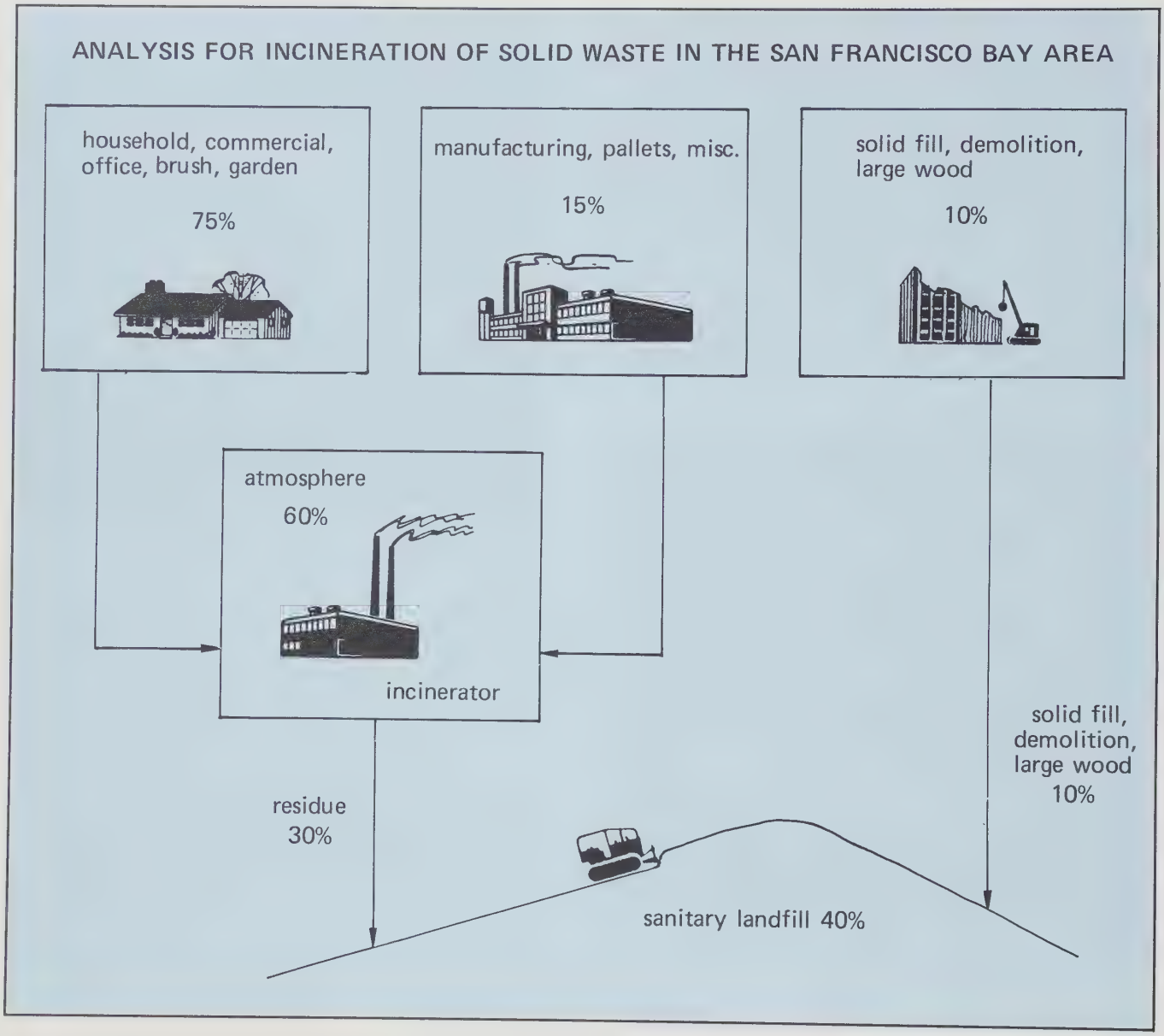
Even if incineration were fully used, there would still be a need for sanitary landfill to handle incineration residue and materials unsuitable for burning. These amount to 40 percent of the original quantity of waste generated in a city. These considerations, combined with the social ramifications of locating incineration plants near populated areas, make it unlikely that municipal incineration as it exists today will ever play a major role in the Bay Area.

INCINERATION & OPEN BURNING

SOURCE	TON/DAY
Residential	100
Commercial	374
Forest	130
Agricultural	786
TOTAL	1,390

*1971 SOURCE INVENTORY OF AIR POLLUTANT EMISSIONS IN THE SAN FRANCISCO BAY AREA

Source: Bay Area Air Pollution Control District



Pyrolysis

In the pyrolysis process, the organic portion of municipal waste is broken down into by-products having some economic value. Pyrolysis, sometimes termed "destructive distillation," is a special high-temperature incineration process conducted in the absence of oxygen, producing a solid carbon residue, a low-grade fuel oil, and a low BTU gas. Unlike normal incineration that uses an excess of air and requires massive pollution abatement equipment, pyrolysis is conducted in the absence of oxygen. As a result, the volume of emissions is small and easier to control.

Laboratory investigations of pyrolysis have been conducted at many universities including University of California, Berkeley; Rensselaer Polytechnic Institute; and New York University. Also, the City of San Diego and the Bureau of Mines have conducted laboratory investigation. Larger pilot plant studies have been conducted by Garrett Research and Development Company, Monsanto Enviro-Chem Systems, Battelle Northwest, the University of West Virginia and Union Carbide.

To date, a full-scale operating plant has not been built in this country although some are planned.

As with incineration, capital costs and operating expenses are high. Also, pyrolysis processes are not capable of handling the bulk of the waste generated in our modern society and must rely on sanitary landfills as a back-up.

Energy Recovery

Each year, U.S. cities produce enough waste to satisfy perhaps as much as 10 percent of the nation's electrical demand. Several projects are underway in this country to explore and exploit this potential energy source using incineration or pyrolysis.

The Navy was one of the first in this county to use incineration to generate steam. the operation began at the Norfolk Naval Station in Virginia in 1967 with a furnace which cost $2.2 million but saves the Navy $50,000 a year. About 140 tons of garbage and trash each day are used to generate about 50,000 pounds of steam every hour. This steam produces electric power and heats buildings throughout the Sewell's Point area. The unburnable residue is scraped from the incinerator and used as landfill.

In St. Louis, the Union Electric Company and the Environmental Protection Agency (EPA) are demonstrating the feasibility of turning garbage into fuel. St. Louis collects about 1000 tons a day of waste. Of this load, as much as 300 tons are shredded, air classified, and ferrous metals magnetically removed. Then a mixture of combustible waste and pulverized coal are blown into two modified coal-fired boilers. The trash contributes about a third of the fuel mixture weight but, because it has about half the heating value of coal, generates only about 15 percent of the heat output.

Although the refuse firing has had no discernible effect on the furnaces, it puts a greater load on dust collection systems because it contains about twice as much ash as coal. Sulfur content is very low, a fraction of 1 percent, which means less sulfur dioxide in the atmosphere. EPA's Office of Air Programs which is supporting the project claims that at least 20 power plants around the country can be converted to burn municipal waste.

SOME FACTS ABOUT REFUSE AS A FUEL

	REFUSE %		COAL %	
Moisture	19.69	- 31.33	6.20	- 10.23
Carbon	23.45	- 33.47	61.29	- 66.18
Hydrogen	3.38	- 4.72	4.49	- 5.58
Nitrogen	0.19	- 0.37	0.83	- 1.31
Chlorine	0.13	- 0.32	0.03	- 0.05
Sulfur	0.19	- 0.33	3.06	- 3.93
Ash	9.43	- 26.83	9.73	- 10.83
Oxygen	15.37	- 31.90	9.28	- 16.10
BTU per pound	4,171	- 5,501	11,258	- 11,931

Source: UNION ELECTRIC COMPANY
St. Louis

In the Bay Area, the Combustion Power Company of Menlo Park has been funded by the federal government since 1965 to develop the CPU-400, a pilot plant designed to recover more than 1000 kilowatts of electric power from burning 100 tons of combustible waste. The full-scale CPU-400 will be a completely automated, non-polluting plant capable of disposing municipal waste while producing about 5 percent of the community's power needs. The process involves shredding the waste, air classification into combustibles—"lights"—and non-combustibles—"heavies," incineration in a fluid bed reactor, hot gas clean-up through inertial separators and feed to a gas-turbine generator.

Stringent tests monitored by the EPA are underway in Menlo Park, and with the CPU-400 program nearing operational status, it promises to be an important contribution to solving the environmental problems of waste disposal and energy production.

In the Los Angeles area, tests are just beginning at two landfill sites. Both the City of Los Angeles and the Los Angeles County Sanitation District are investigating the use of methane gas—produced as organics in a landfill decompose—as a fuel to power a turbine generator. Non-conclusive data is available but initial testing is encouraging.

There are other ways to get power from garbage. The EPA recently granted $3 million to San Diego County to demonstrate a pyrolysis plant using a process developed by the Garrett Research and Development Company. Pilot experiments indicate that each ton of collected waste will yield about one barrel of low-sulfur oil. This new fuel is compatible with most grades of conventional fuel oil and has about three quarters of the heating value of No. 6 fuel oil.

The EPA has also granted $6 million to the City of Baltimore to try pyrolysis in a $14 million facility due to start in two years. About 1000 tons a day will be converted into synthetic gas using the Monsanto Co. "Landgard" system. A rotary kiln is used as the pyrolysis reactor in this system, and the gas developed will be burned to make steam for Baltimore Gas and Electric Co.

Composting

Waste reduction through composting has been attempted unsuccessfully across the country. Cities throughout the United States have an unfortunate history of composting failures. Since 1951, nearly 20 composting plants were built, but by 1971, only two were still operating. Locally, in 1950, the City of Oakland attempted to compost its wastes through Comco, Compost Corporation of America. At one time, this plant handled nearly 100 tons daily, then a quarter of Oakland's daily waste. But despite this encouraging beginning, the lack of profitable compost markets eventually forced the plant to close. Without available markets in the urban area where wastes are generated, transportation costs become too great for hauling the material to outlying agricultural areas where it can be useful.

European and Asian composting operations have also experienced failures due to expensive production and distribution costs for the compost. Nevertheless, West Germany continues to compost about 1 percent of its waste, while Holland, because of its unique ability to use humus in reclaiming submerged lands from the North Sea, has used up to 17 percent of its waste as compost.

Even if it were economically feasible, composting can convert less than 50 percent of the total waste stream. At $8 to $30 per ton, the cost of composting would place a considerable burden on the public which now pays only $1.50 to $4 for landfilling.

ESTIMATED COSTS FOR COMPOSTING MUNICIPAL SOLID WASTES

	PLANT INPUT	
Costs	50 tons/day	300 tons/day
Operating and capital	$10-20/ton	$8-12/ton
Income		
Paper, metal, and misc. salvage	$0-2/ton	$2-5/ton
Compost	$0-4/ton*	$0-2/ton*
Net Cost		
Range	$4-20/ton	$1-10/ton
Probable	$12/ton	$8/ton

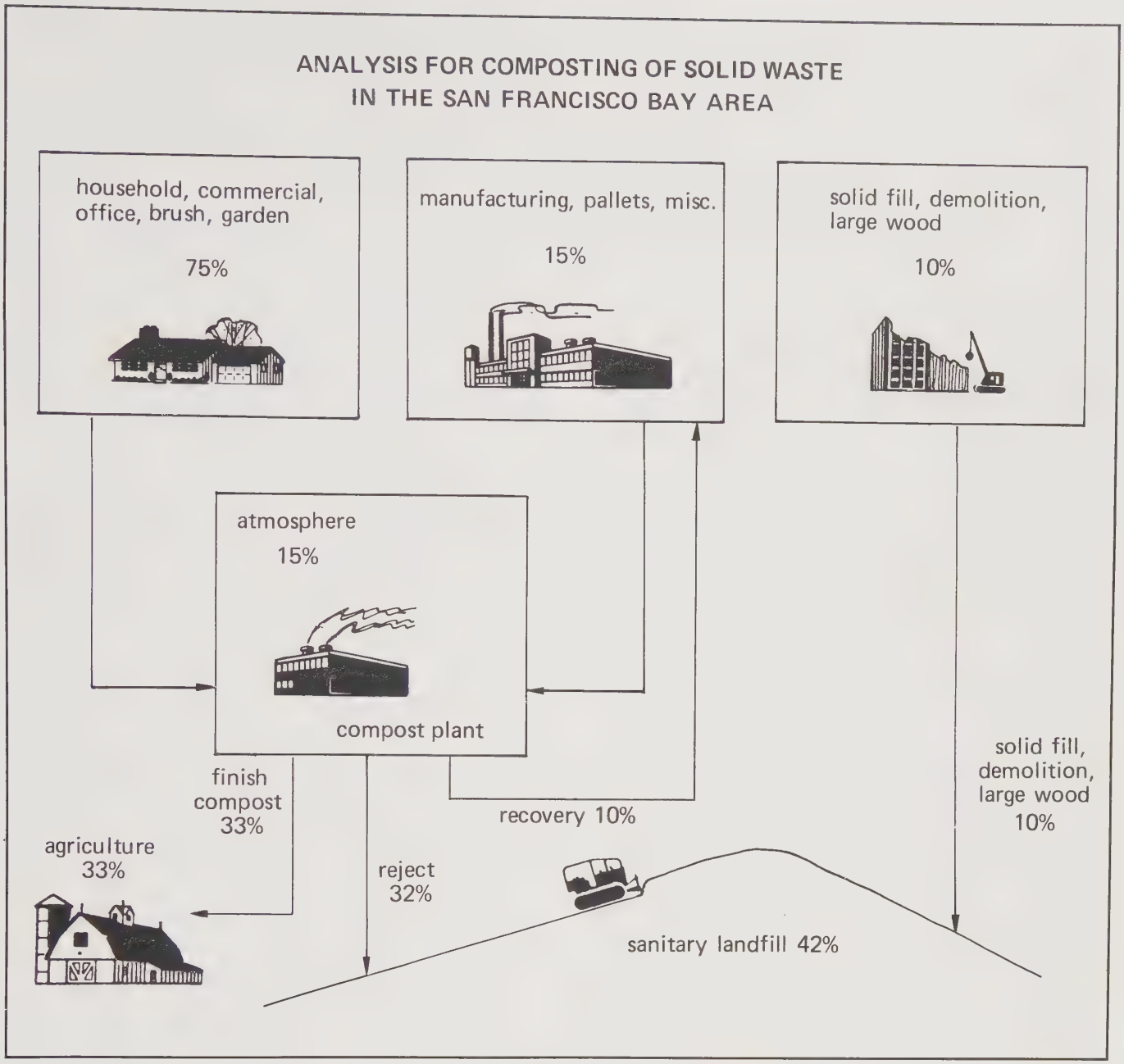
*Costs per ton of refuse processed; assuming a typical 50 percent yield, break-even sale prices for the compost would be twice the values shown.

Source: Gunnerson, Charles G., "The Potential of Composting in Resource Recovery," presented at the 137th Annual Meeting of the American Association for the Advancement of Science, Chicago, December 1970.

MUNICIPAL REFUSE COMPOSTING PLANTS IN THE UNITED STATES

Location	Company	Process	Capacity Ton/Day	Wastes	Began Operation	January 1971 Status
Altoona, Pa.	Altoona FAM, Inc.	Fairfield-Hardy	45	Garbage, paper	1951 1963	Operating
Boulder, Colo.	Harry Gorby	Windrow	100	Mixed refuse	1965	Operating on demand basis
Gainesville, Fla.	Gainesville Municipal Waste Conversion Authority (Grant from PHS)	Metro Waste Conversion	150	Mixed refuse, digested sludge	1968 1970	Closed 1971
Houston, Tex.	Metropolitan Waste Conversion Corp.	Metro Waste Conversion	360	Mixed refuse, raw sludge	1966	Operating on demand basis
Houston, Tex.	United Compost Services, Inc.	Snell	300	Mixed refuse	1966	Closed 1966
Johnson City, Tenn.	Joint USPHS-TVA	Windrow	52	Mixed refuse, raw sludge	1967	Closed 1971
Largo, Fla.	Peninsular Organics, Inc.	Metro Waste Conversion	50	Mixed refuse, digested sludge	1963	Closed 1967 (pilot plant)
Norman, Okla.	International Disposal Corp.	Naturizer	35	Mixed refuse	1959	Closed 1964
Mobile, Ala.	City of Mobile	Windrow (formerly) briquetting process)	300	Mixed refuse, digested sludge	1966	Operating on demand basis
New York, N.Y.	Ecology, Inc.	Varro	150	Mixed refuse	1971	Operating
Phoenix, Ariz.	Arizona Biochemical Co.	Dano	300	Mixed refuse	1963	Closed 1965
Sacramento, Calif.	Dano of America, Inc.	Dano	40	Mixed refuse	1956	Closed 1963
San Fernando, Calif.	International Disposal Corp.	Naturizer	70	Mixed refuse	1963	Closed 1964
San Juan, P. R.	Fairfield Engineering Co.	Fairfield-Hardy	150	Mixed refuse	1969	Closed 1971
Springfield, Mass.	Springfield Organic Fertilizer Co.	Frazer-Eweson	20	Garbage	1954 1961	Closed 1962
St. Petersburg, Fla.	Westinghouse Corp.	Naturizer	105	Mixed refuse	1966	Operating on demand basis
Williamston, Mich.	City of Williamston	Riker	4	Garbage, raw sludge, corn cobs	1955	Closed 1962
Wilmington, Ohio	Good Riddance, Inc.	Windrow	20	Mixed refuse	1963	Closed 1965

Source: Breidenbach, A.W., et al., "Composting of Municipal Solid Wastes in the United States," U.S. Environmental Protection Agency Publication, Washington, D. C., 1971


ANALYSIS FOR COMPOSTING OF SOLID WASTE
IN THE SAN FRANCISCO BAY AREA
household, commercial, office, brush, garden
75%
manufacturing, pallets, misc.
15%
solid fill, demolition, large wood
10%
atmosphere
15%
compost plant
finish compost 33%
recovery 10%
agriculture 33%
reject 32%
sanitary landfill 42%
solid fill, demolition, large wood 10%

Ocean Disposal

Solid wastes disposed in the ocean have been summarized into seven categories. A 1969 Dillingham Corporation survey identified 35 marine solid waste disposal sites on the West Coast that received dredging spoils, cannery wastes, industrial chemicals, oil drilling mud, filter cake, explosive and radioactive waste and miscellaneous wastes.

Wastes derived from commercial canning operations as well as garbage and trash from commercial and military ships were often dumped at sea. At present, San Francisco Bay Area canners dispose their wastes on land. And, with improved handling methods for land application it is expected that ocean disposal of these wastes will be a bygone practice.

Other wastes that have been dumped at sea include industrial chemicals—acids, sludges, cleaners, spent caustics, and plating solutions—originating from oil refineries, chemical plants, plating and chemical operations. Today, most of these wastes are disposed in Class I landfill sites.

Drilling wastes from off-shore oil drilling consists of clay base mud and, as the wells begin producing, the disposal operation is gradually phased out. Filter cake used in the extraction of algin from kelp plant harvesting is dumped off the coast of Southern California. Miscellaneous wastes—spoiled foods, airplane parts, confiscated guns and weapons, special chemical and medical wastes—are disposed intermittently and do not usually use established marine disposal sites. No date has been publicized about the nature or amount of explosive or radioactive waste deposited in offshore sites.

Specialized Land Application

Cannery Waste

The fruit and vegetable canneries in Santa Clara County produce approximately 125,000 tons of waste a year. Until recently, haulers dumped this waste in fields for cattle feed. Within a few days the waste would putrify and produce flies and odor affecting nearby residences. In order to satisfy the complaints of homeowners subjected to these nuisances, the San Jose area canneries and the County Health Department embarked on a program to handle these wastes in an environmentally acceptable way.

In 1970, a 2300-acre site of flat land was leased in Santa Clara and San Benito Counties. The Cooperative for Environmental Improvement (C.E.I.) comprised of San Jose area canners, contracted with the site operator to prepare the ground by disking and to manage the spreading and drying operation.

During the canning season, trucks haul the fruit and vegetable waste to the site where a large rubber-tired tractor towing two heavy pipe sections runs over the waste and spreads it in a thin layer. When the waste layer is dry, the tractor disks it into the soil, repeating the process three or four times until the food wastes and soil are completely mixed. About one week is needed for the total spreading and drying cycle.

The C.E.I. cannery waste land-spreading operation has completed two successful seasons without fly or odor problems and adding cannery waste to the high alkaline clay adobe soil actually improves it. The methods developed in this program comply in every detail with the standards set by the Santa Clara County Health Department.

Sewage Sludge

Increasingly stringent regulations on ocean and Bay disposal of sewage effluent are being imposed by the State Water Resources Control Board and the EPA. As a result, the amount of sewage sludge produced by treatment plants is steadily climbing. Some of this waste is incinerated at comparatively high tonnage costs—from $50 to $150 per ton—in special high-temperature, high-pressure vessels.

However, as more and more solids must be taken out of the raw sewage, annual disposal costs for sludge may double and even triple. As a result, cities are looking to land disposal as a solution. At landfill sites, where most sludge is disposed, it is mixed with other solid waste in limited ratios, relying on the absorptive capacity of the paper and other combustible material. This type of mixing can be done at the ratio of one ton sewage sludge for each five to ten tons of municipal waste. At the Mountain View landfill, for instance, some 200 tons of digested sludge is mixed with about 2300 tons of municipal waste each day. Even more sludge can be disposed during dry weather when it can be mixed with soil quite satisfactorily, enriching it and producing healthy vegetation.

Liquid Industrial and Hazardous Wastes

Hazardous wastes require special disposal methods. Nowdays, these wastes are principally disposed in land by ponding with evaporation and infiltration, soil mixing, deep well injection, or

blending with other wastes in a sanitary landfill. An initial process may neutralize and incinerate vapors before residues are finally disposed. The foremost considerations in these operations are the health and safety of operating personnel and the public. And protecting water quality and preventing air pollution are also vitally important.

FINANCING

Financing may be the most important part of the solid waste process. The increasing demand to capitalize collection equipment, transfer stations, resource recovery plants, and landfill operations coupled with tremendous working capital requirements to successfully implement responsible programs, has drawn the attention of investment managers and financial analysts.

The 1972 Report of the President's Council on Environmental Quality estimates annual expenditures of nearly $7 billion nationwide for solid waste management. In the Bay Area, both the public and private sectors spend well over $100 million annually on solid waste management. There is no indication that the bill will get any smaller. On the contrary, several factors indicate a continual rise in costs due to increased capital expenditures for more modern facilities.

For example, many Bay Area landfills do not meet the operating standards set for a sanitary landfill. Operational improvements are needed which will require large outlays for new equipment to provide proper compaction and daily covering. Some sites must import dirt for cover material and, because of the extreme costs, are not able to cover on a daily basis.

Even in well operated sanitary landfills which use the most modern methods and reliable equipment, operational costs are moving upward. The cost of equipment increases between 10 and 15 percent each year. To meet safety standards on heavy equipment, an additional 10 percent is being added to machines. In dollars and cents this means it costs nearly $8000 more to equip an environmental operator cab with roll-over canopy, air conditioning, sound suppression, and other related features. Faced with additional costs to meet new monitoring standards imposed by control agencies, operators are calling on engineering and planning expertise, for the first time in many cases, to establish programs of compliance.

The highly labor-intensive nature of collection will remain unchanged in the near future. But as collection equipment becomes more sophisticated, purchase prices will continue to rise. Tougher noise abatement laws are being passed, requiring modifications to collection trucks. In five years, San Francisco collection trucks will have to be quieter than a motorcycle to operate legally.

As close-in disposal sites are completed, longer-haul distances with transfer will be necessary. Two- and three-million dollar investments in land, buildings, and equipment will not be unusual for new transfer operation.

Resource recovery has salvaged tin cans from municipal waste for many years at Bay Area landfills with relatively modest investments in portable processing equipment. However, the most recent installation at the San Francisco transfer station represents an investment approaching three-quarters of a million dollars. As more State and Federal legislation is produced providing incentives for using recycled material, it is expected that even more sophisticated recovery plants will begin to operate. Latest estimates for adding resource recovery facilities to existing solid waste processing stations indicate a $2 million price tag to recover glass, aluminum, and other non-ferrous metals.

Thus, a total package to receive waste at a transfer station, process it to recover tin cans and light ferrous metals, reprocess it to salvage glass, aluminum, and other non-ferrous metals could easily cost between $5 and $6 million.

It is quite evident that as these costs for environmental improvement continue to increase, they will eventually be passed back to the user and the general public.

Methods of Financing

These increased costs can be passed back in a number of ways. With sharp increases on the way, it is crucial for both government and industry to understand the options available to finance new equipment and facilities. The four alternatives cited most frequently are pay-as-you-go, leasing, public subsidy, and borrowing.

The choice of any of these depends on the type of project. Special financing is available for collection trucks, namely short-term, 3 to 5 years. This financing is not available for large capital improvements such as transfer stations or sanitary landfill site where long-term, 10-to-20 year financing is possible. Also, the kind of solid waste agency desiring support has a bearing on what kind of financing is available. Third, the legal, political, and technical constraints associated with the project will have a marked effect on the type of financing.

In the Bay Area, most disposal facilities are owned and operated by private industry. New projects owned by a company and privately financed might be financed through corporate bonds, equity, leasing, or a lease-purchase agreement. Industrial revenue bonds and industrial revenue pollution control bonds might be considered since the state or local government issuing the bonds does not pledge its credit. Instead, the bonds are sold to finance a facility which is then sold or leased to a private

SUMMARY OF ALTERNATIVE METHODS OF FINANCING CAPITAL REQUIREMENTS

ITEM	PAY-AS-YOU-GO	LEASING	SUBSIDIES/GRANTS	BORROWED FUNDS
1. EXPLANATION	1. Yearly appropriations to finance requirements—either by accumulating funds in advance or meeting obligations as they occur.	1. Straight rental with no intent to purchase or own (actually a form of pay-as-you-go).	1. State or federal aid available for acquisition and construction of facilities, or for equipment acquisition.	1. Long-term debt financing—analogous to mortgage financing. Several methods available—see Table II for comparison.
2. ADVANTAGES	2a. Generally, the least expensive. b. Accumulated funds provide maximum flexibility to meet unanticipated needs. c. More certain than subsidies or bond issues requiring vote.	2a. Requires no capital investment. b. Provides high degree of flexibility in meeting unexpected or changing conditions such as location or amount of space required; and amount or type of equipment.	2a. Lower the property tax burden or reduce service charges. b. Represent the return of local taxpayers' money. c. Can reduce total costs by permitting earlier construction/acquisition or by reducing amount of borrowed funds used.	2. These are general advantages applicable to all methods. a. Reduce immediate financing requirements. b. Permit construction of critical facilities or acquisition of equipment without delay. c. May provide some savings through earlier construction/acquisition—such as avoiding inflationary construction costs or rental costs. d. We can expect to repay with "cheaper dollars" if inflation continues.
3. DISADVANTAGES	3a. Exclusive use usually results in significant tax rate increase. b. Relieves future citizens from responsibility of paying for facilities/equipment from which they will benefit.	3a. Most expensive if used over extended period. b. Does not produce any equity in facility/equipment. c. Leased facilities sometime create operating problems because of location or layout: Leased equipment may not meet specifications we would use for purchase of new equipment.	3a. Regulations generally accompany the money. b. Some costs involved in preparing and processing applications. c. Uncertainty of receipt due to change in rules or cutback of funds.	3a. Interest costs are major drawback, can vary from 30% to 50% of principal depending on: 1) Repayment period; 2) Schedule of principal retirement; and 3) Interest rate. b. Limits (practical and legal) to amount of borrowing that can be used.
4. PROPOSED GUIDELINES	4. As a general statement, pay-as-you-go is the best method of financing and should be used as extensively as possible with consideration given to: a) our total budgetary requirements and financial resources; b) our total construction needs; c) the benefit of the facilities/equipment to future residents; and d) the availability of subsidies. Pay-as-you-go should be used whenever possible for minor needs or for additions, improvements, and modifications to existing structures/equipment.	4. Whenever needs are well defined, short-term renting generally should be considered only as a temporary solution while plans and/or financing arrangements can be developed for permanent facilities/equipment. Three- to five-year leases should be considered whenever major uncertainties exist concerning the need for space—either in terms of scope, timing, or location.	4. The availability of subsidies should not be used as the justification for constructing a facility/acquiring equipment. However, an attempt should be made to obtain subsidies on approved projects to reduce the local property tax burden/service charges. Any financing plan which anticipates subsidies should be flexible enough to allow for some under-collection.	4. Long-term debt financing should be used if a) a pay-as-you-go policy places too great a burden on current sources; and b) borrowing does not create equally severe future financing problems. The borrowing method should be evaluated in relation to the type of facility/equipment to be acquired.

Source: Sacramento County, California, Office of the County Executive, March 6, 1968. "Refuse Collection Operation"

company. That company makes installment payments as security for the issue. Because the IRS has imposed several important constraints, the financing option of tax exempt bonds must be studied thoroughly before making a decision.

However, revenue bond financing provides a low-cost means of obtaining capital for advanced solid waste facilities. This type of financing relies on user charges based on the level of service rather than on general tax revenues.

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SANITARY LANDFILL DESIGN AND OPERATION

Nationwide, over 90 percent of the country's waste is disposed on land. But, according to the findings of the Mission 5000 Program sponsored by the Environmental Protection Agency, in 1970, of approximately 16,000 sites categorized as sanitary landfills, only five percent met acceptable standards.

In the San Francisco Bay Area, landfilling is used almost exclusively to dispose thousands of tons of daily waste. A land disposal is versatile enough to handle any type of waste regardless of its size, weight, or origin. Moreover, properly located sanitary landfills can safely dispose of hazardous and liquid industrial wastes without endangering the environment or public health.

A sanitary landfill is not an open dump. By definition it is a method of waste disposal on land. Using engineering principles and construction methods it confines waste to the smallest practical area, compacts it into the lowest possible volume, and covers it with a layer of earth at the end of each day's operation to prevent nuisances and hazards to public health and safety. Importantly—it provides for environmental protection.

Filling operations that don't consistently conform to these standards are classified as modified landfills, open dumps, or open burning dumps. In the San Francisco Bay Area in 1972 only five of the 60 landfill sites operating could be classified as sanitary landfills. The others were modified landfills with periodic cover.

Landfilling with waste has proven to be an environmentally and economically sound way to improve marginal land and restore its usefulness. There are a number of places in the Bay Area which have been developed on land filled with waste . . . Golden Gate Fields in Berkeley, the Galbraith Municipal Golf Course and the Raiders' Training Field in Oakland, and the Shoreline Regional Park in Mountain View.

PLANNING AND DESIGN

A sanitary landfill is an engineering project. It requires planning and sound engineering principles comparable to any other major construction job. Planning lays the basic groundwork for site selection, design, and operation. In selecting a waste disposal site, considerations of the future will accrue benefits in longevity and operational procedures. These considerations include the waste source and type, land volume, zoning, accessibility, distance from source, geology, climate, and requirements for cover material. In

the same way, designing provides the plans and specifications outlining all the necessary features, operating procedures, and suitable equipment.

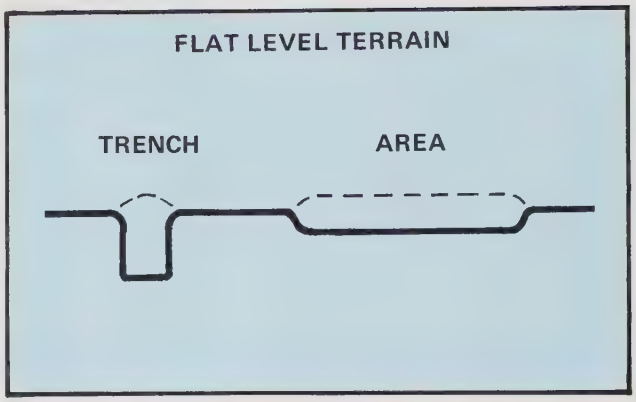
A sanitary landfill operation is not limited by terrain. It can be conducted in flat areas, or canyons, exhausted quarries and pits. Each of these can be found throughout the nine Bay Area counties. Generally in the South Bay waste is disposed on low flat land. Canyon operations are carried out in every county except San Francisco. Abandoned quarries and pits are being filled in only five locations at the present time.

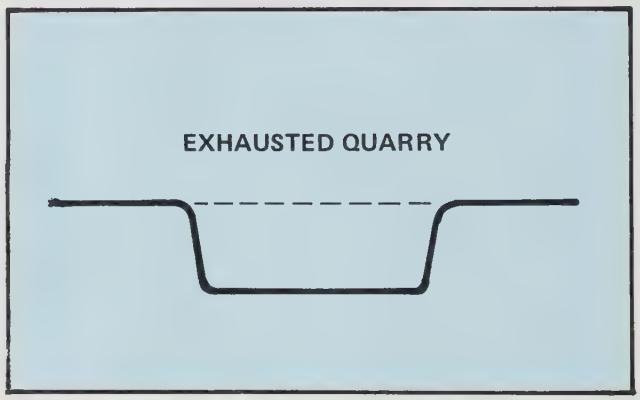
Flat, low-lying land provides the least capacity per acre for filling. Elevations are usually limited from 20 to 30 feet above the surrounding property and excavations rarely exceed a few feet without requiring extensive construction of impervious seals to protect ground water. However, in the South Bay where vast acreage has subsided from pumping and is subject to storm flooding, refuse disposal would provide a regional waste facility. At the same time it would reclaim land lost from poor ground water management.

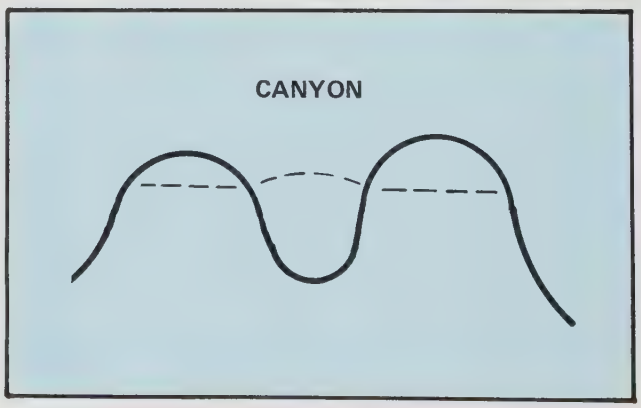
Quarries or pits provide opportunities to dispose of waste and to restore land. Abandoned pits are safety and aesthetic liabilities to communities. Filling the pits to a safer elevation and a more attractive contour pattern changes a liability into a community asset. Special protective measures are needed as gravel is generally excavated until ground water is encountered. Often highly pervious soils allow both gases and liquids to flow freely. Before filling begins, impervious seals of clays or other materials must be installed to protect ground water supply. Also suitable cover material is often not present in exhausted quarries and must be imported.

In a canyon landfill where sites are generally remote, there is less potential for ground water pollution than there is near population centers. Filling begins at the mouth of the canyon and continues upward in lifts of 10 to 20 feet. As the fill progresses, cover material is taken from the sides and rear of the canyon. Front-of-face slopes usually vary on a horizontal to vertical ratio between 4:1 and 2:1 depending on the final use and appearance planned for the site. Throughout the filling operation drainage is provided by cutoff trenches on the canyon sides and by grades maintained on the fill portion. Canyons provide large volume per acre because total fills are deep—often exceeding two hundred feet.

Regardless of the landfill location or terrain, a primary factor is the amount of earth available for daily covering operations. Normally this is not a







A PARADIGM

To illustrate how all of these factors interact, the following paradigm is described.

A service area of 250,000 population needs a disposal site for the next 25 years. At the projected growth rate the population will double in 25 years to 500,000. A waste generation factor of one ton per capita per year (5.5 pounds per capita per day) is assumed and will remain constant.

Calculations are needed to determine the number of acres required for the site:

1. Average population for 25-year period
   (250,000 + 500,000) ÷ 2 = 375,000
2. Waste tonnage disposed over 25 years
   375,000 x 1.0 tons per year x 25 years =
   9.4 million tons
3. Volume required for 25-year period
   (9.4 million tons x 1,200 pound per cubic yard)
   ÷ 2,000 pounds per ton = 5.6 million cubic yards
   or, 9,700 acre feet

Once this volume has been determined, several land options are available. A level site averages a waste depth of 30 feet. Thus, the site acreage needed is 9,700 acre feet ÷ 30 feet = 324 acres.

By comparison, a canyon site with an average fill depth of 180 feet will only require about 100 acres of land area or about one-third of that required for a flat site.

In the same way, in a quarry site with nearly vertical banks, a 100-foot depth requires only 97 acres of land.

These calculations do not include additional land area needed for earth cover which is usually calculated at a factor of one part earth to four parts refuse.

problem for canyon sites as adequate amounts of earth are available on the slopes. However, flat areas with high water table require excavating procedures to provide cover and to protect the ground water.

Exhausted quarries or behind-dike filling often need earth imported from outside sources adding to operational costs.

A good rule-of-thumb is to plan for a daily cover of waste mixed with earth in a 4:1 ratio. That is, for each four cubic yards of waste compacted in place, one cubic yard of soil would be used for daily cover. This ratio varies with the daily volume and smaller operations will use a higher proportion of earth. Additional soil must be reserved for a final cover. On a completed site a minimum depth of three feet allows for landscaping, irrigation, and grading.

SITE REQUIREMENTS

Land or volume requirements for a site can be determined from information available for a specific area. It is necessary to know the service population and its projected growth, existing generation rate, equipment to be used, expected compaction, type of terrain, and expected site life. Most landfills in the Bay Area receive a mixture of waste from residential, commercial, institutional, industrial, and demolition sources as well as the general public. For this cross-section of sources, a water generation rate of about one ton per person per year—about 5.5 pounds per capita per day—can be expected.

A practical life span must be determined on the basis of conventional financing methods. The larger the expenditures for capital improvements—such as entrance roads, drainage structures, scale facilities, landscaping—the longer the amortization period. Sites located where they will serve for 15 to 25 years will lower amortization rates.

Another consideration is the effectiveness of compaction equipment or anticipated in-place density of waste. In-place density ranges between 800 and 1400 pounds per cubic yard depending on the machine used.

OPERATION

Appearance is an important element in a sanitary landfill operation. Paper and litter control are a constant chore. Restricting on-site salvage operations will keep a good sanitary landfill from looking like an open dump. As the center of activity, the

working face requires the most attention. In order to minimize papers from blowing, the exposed face should be kept to a minimum. Determining prevailing wind direction and using both permanent and portable fences will help control paper. Of course, the most effective paper control is by covering the waste with earth.

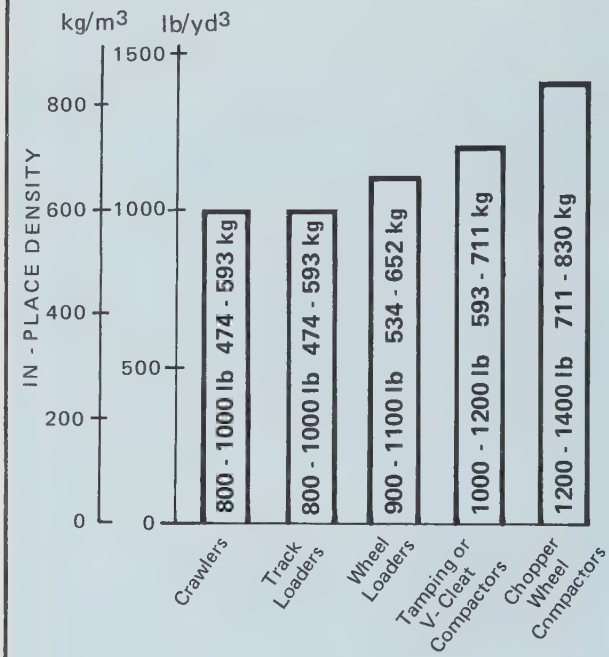
Supervision and inspection, operator training, planning fill sequence, equipment maintenance and service, equipment and operator safety, and cost analysis are other on-going operational responsibilities.

Supervision by an experienced foreman will produce a clean, economical landfill operation. Proper training of equipment operators in methods of spreading and compaction and developing safety is imperative. The Federal Occupational Safety and Health Act of 1970 (OSHA) makes employers responsible for providing a place of employment free from recognized hazards causing, or likely to cause, death or serious physical harm. The Act provides for mandatory penalities for violations of fines and/or imprisonment. The major effect on the waste management industry is on the area of operator safety. Equipment used in landfill operations must be brought up to OSHA standards in compliance with schedules adopted by the Labor Department's Contruction Safety Advisory Committee. In February 1972, the Committee adopted a schedule covering requirements for Roll-Over Protective Structures (ROPS) that involves retrofitting all earthmoving equipment, including new equipment.

Caterpiller Tractor Co. Photo

ROLL-OVER PROTECTIVE STRUCTURE REQUIRED by OSHA

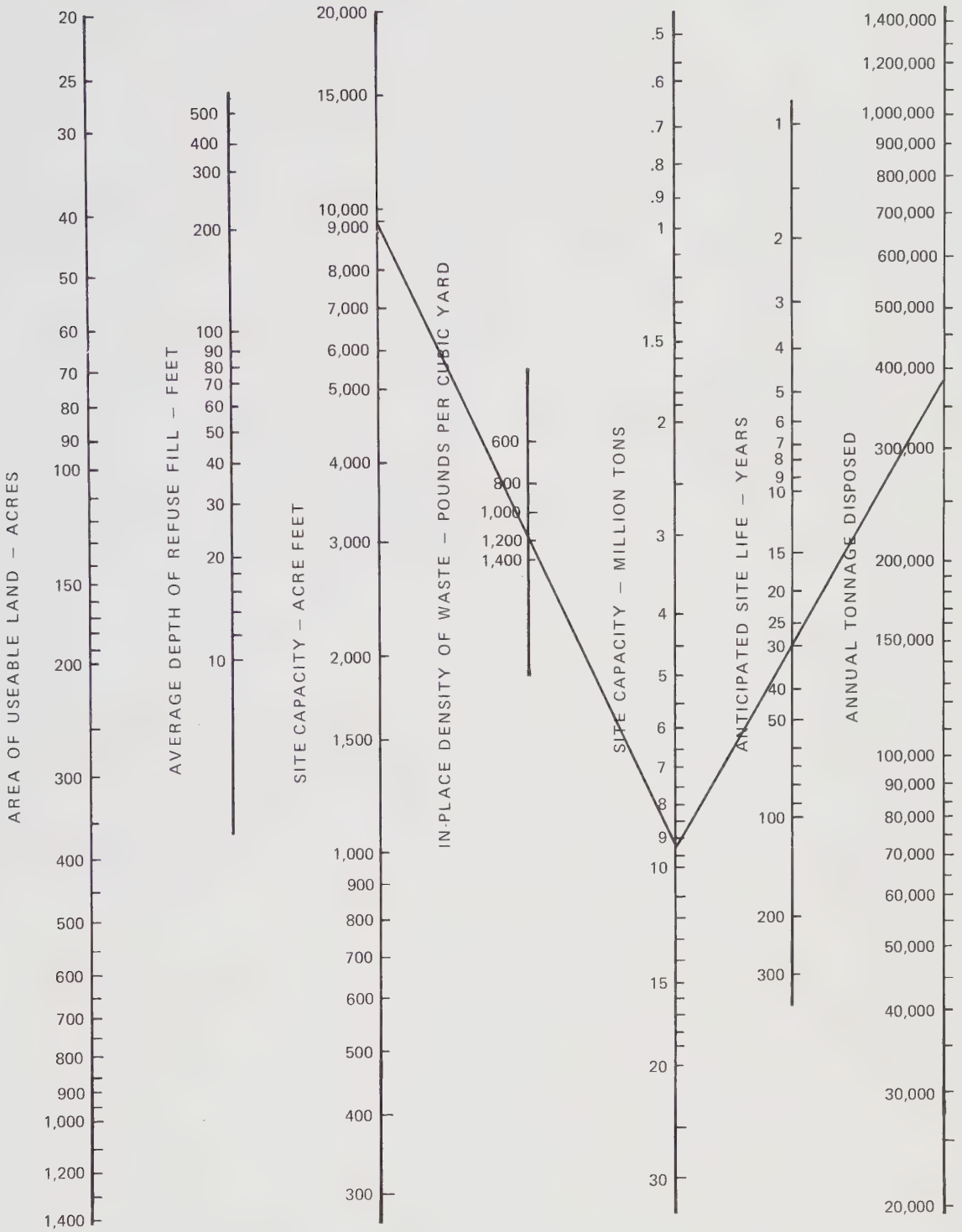
LANDFILL DENSITY



These bars represent final densities achieved in 3 to 5 passes by the various machine types, as found in various tests conducted by Caterpillar Tractor Co. over several years. Conditions are those commonly found in landfill operations: 20% soil cover and 80% residential and commercial refuse. Refuse composition: 48% paper, 16% garbage, 9% yard trimmings. 8% metal, 6% glass and 13% other materials. Average weight 250-350 lb. per cu. yd. (148-208 Kg/m^3) before compaction. Moisture content 10-80% by weight.

Source: MACHINES FOR SANITARY LANDFILL
CATERPILLER TRACTOR COMPANY

LANDFILL CAPACITY NOMOGRAPH



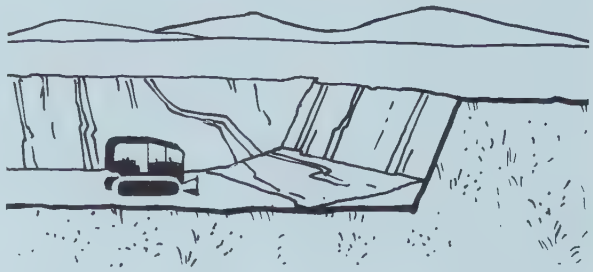
Nomographs are used to calculate landfill factors. By connecting known data distributed on two vertical lines with a straight line, it is possible to pinpoint another characteristic represented on a third vertical line. For example, as shown here, a site with 9700-acre feet capacity compacted to 1200 pounds per cubic yard density will hold 9.4 million tons. Or, a site with a 9.4-million ton capacity, receiving an average of 375,000 tons per year, can be expected to last 25 years.

Source: EASLEY & BRASSY CORP. © 1973

SANITARY LANDFILL TECHNIQUES

There are three fundamental techniques used for sanitary filling. These are commonly known as the trench, area, and ramp methods. The method appropriate for a specific operation depends on the amount of waste and the site's terrain. The trench method is suitable for flat areas where a trench is excavated for the waste with the excavated earth used for cover. Trenching consumes acreage at a fast rate and is not economical for handling large quantities of waste.

TRENCH TECHNIQUE



In the area method, on the other hand, waste is spread on the ground or on previous lifts and compacted in horizontal layers about two feet high. The layers are brought up to complete a lift usually 10 to 12 feet thick. This method is suitable for any terrain.

AREA TECHNIQUE

In the ramp method, waste is spread and compacted up a sloped face in thin layers. Lifts of 20 feet each are not uncommon in high-volume landfill operations. Where crawler tractors are used, maximum compaction is attained by using the ramp. A variation is to push the waste down the ramp with site conditions dictating the direction.

RAMP TECHNIQUE

Source: EASLEY & BRASSY CORP.

Rodent and vector control is a simple matter accomplished by daily covering of wastes. The lack of exposed food and harborage discourages rats from settling on the site. A minimum daily compacted cover of six inches is sufficient to prevent houseflies from emerging from the fill. Periodic inspection by a pest control company also helps.

Dust can be controlled by regularly sprinkling access roads and the working face with a water truck. Completed areas with dust problems can be planted with wild grass and alfalfa.

Although burning is not permitted in a sanitary landfill, an occasional fire may occur because of the very nature of the operation. Advance preparation will minimize such emergencies. Fire protection can be provided with the water truck but the most effective way is to smother fire with dirt. A stockpile of dirt near the working face can handle hot loads such as ashes. Compacting waste as it is received to eliminate voids and pockets is the best way of preventing fire from breaking out within the fill.

In addition to fire and dust, odors and fumes can be classified as air pollutants. Odors are more of a nuisance than a health hazard. But when odorous wastes are brought to the fill, they can be handled as they are dumped to minimize the escape of fumes. Other natural landfill odors are caused as wastes decompose. Unlike other fills, a sanitary landfill contains cells varying in size, density, and content. The heterogeneous nature of solid waste makes predicting the rate of settlement, decomposition, stability, and other characteristic more of an art than a science.

LANDFILL WASTES GROUPINGS

GROUP 1 WASTES

Group 1 wastes consist of or contain toxic substances and substances which could significantly impair the quality of usable waters. Examples include but are not limited to the following:

(a) Municipal origin
  (1) Saline fluids from water or waste treatment processes
  (2) Community incinerator ashes
  (3) Toxic chemical toilet waste
(b) Industrial origin
  (1) Brines from food processing, oil well production, water treatment, industrial processes and geothermal plants
  (2) Toxic and hazardous fluids such as cleaning fluids, petroleum fractions, acids, alkalies, phenols, and spent washing fluids.
  (3) Substances from which toxic materials can leach such as ashes, chemical mixtures, and mine tailings.
  (4) Rotary drilling mud containing toxic materials
(c) Agricultural origin
  (1) Pesticides or chemical fertilizers
  (2) Discarded chemical containers
(d) Other toxic waste such as compounds of arsenic, mercury or chemical warfare agents.

GROUP 2 WASTES

Group 2 wastes consist of or contain chemically or biologically decomposable material which does not include toxic substances nor those capable of significantly impairing the quality of usable waters. Examples include but are not limited to the following:

(a) Municipal origin
  (1) Garbage from handling, preparation, processing or serving of food or food products
  (2) Rubbish such as paper, cardboard, tin cans, cloth, glass, etc.
  (3) Construction and demolition materials such as paper, cardboard, wood, metal, glass, rubber products, roofing paper, and wallpaper
  (4) Street refuse such as sweepings, dirt, leaves, catch basin cleanings, litter, yard clippings, glass, paper, wood and metals
  (5) Dead animals and portions thereof
  (6) Abandoned vehicles
  (7) Sewage treatment residue such as solids from screens and grit chambers, dewatered sludge, and septic tank pumpings
  (8) Water treatment residue such as solid organic matter collected on screens and in settling tanks
  (9) Ashes from household burning
  (10) Infectious materials and hospital or laboratory wastes authorized for disposal to land by official agencies, charged with control of plant, animal or human disease
  (11) Magnesium and other highly flammable or pyrophoric materials
  (12) Tires and rubber scrap
(b) Agricultural origin
  (1) Plant residues from the production of crops including but not limited to stalks, vines, green drops, culls, stubble, hulls, hulls, lint, seed, roots, stumps, prunings, and trimmings
  (2) Manures
  (3) Dead animals or portions thereof
  (4) Adequately cleansed pesticide containers

GROUP 3 WASTES

Group 3 consist entirely of nonwater soluble nondecomposable inert solids. Examples include but are not limited to the following:

(a) Construction and demolition wastes such as earth, rock, concrete, asphalt paving fragments, inert plastics, plasterboard, and demolition material containing minor amounts of wood and metals.

(b) Industrial wastes such as clay products, glass, inert slags, asbestos, inert tailings, and inert plastics.

Groupings as adopted by the California State Water Resources Control Board, March 2, 1972.

CLASSIFICATION OF WASTE DISPOSAL SITES

CLASS I DISPOSAL SITES

Those sites at which complete protection for the quality of ground and surface waters and public health and wildlife resources is provided for all time from waste deposited therein. These sites are designated as capable of accepting for disposal Groups 1, 2, and 3 wastes. The following criteria must be met for qualification as Class I.

(a) Geological conditions are naturally capable of preventing vertical hydraulic continuity between liquids and gases emanating from the waste in the site and usable surface or ground waters.
(b) Geological conditions are naturally capable of preventing lateral hydraulic continuity between liquids and gases emanating from wastes in the site and usable surface or ground waters, or the disposal area has been modified to achieve such capability.
(c) Underlying geological formations which contain rock fractures or fissures of questionable permeability must be permanently sealed to provide a competent barrier to the movement of liquids or gases from the disposal site.
(d) Inundation of disposal areas shall not occur until the site is closed in accordance with requirements of the regional board.
(e) Disposal areas shall not be subject to washout.
(f) Leachate and subsurface flow into the disposal area shall be contained within the site unless other disposition is made in accordance with requirements of the regional board.
(g) Sites shall not be located over zones of active faulting or where other forms of geological change would impair the competence of natural features or artificial barriers which prevent continuity with usable waters.
(h) Sites made suitable for use by man-made physical barriers shall not be located where improper operation or maintenance of such structures could permit the waste, leachate, or gases to contact usable ground or surface water.
(i) Sites which comply with a, b, c, d, e, f, g, and h but would be subject to inundation by a tide or a flood of greater than 100-year frequency may be considered by the regional board as a limited Class I disposal site.

CLASS II DISPOSAL SITES

Those sites at which protection to ground and surface waters and public health and wildlife resources is provided from Groups 2 and 3 wastes.

Class II-1 sites are those overlying usable groundwater, and natural geologic conditions are capable of preventing hydraulic continuity between liquids or gases and usable water, or the disposal site has been modified to achieve such capability.

Class II-2 sites are those having hydraulic continuity with usable ground water but geologic and hydraulic feautres assure protection of water quality. Such features might include soil type, artificial barriers, or sufficient depth of ground water.

The following criteria must be met for qualification as Class II.

(a) Disposal areas shall be protected by natural or artificial features so as to assure protection from any washout and from inundation which could occur as a result of tides of floods having a predicted frequency of once in 100 years.
(b) Surface drainage from tributary areas shall not contact Group 2 wastes in the site during disposal operations and for the active life of the site.
(c) Gases and leachate emanating from waste in the site shall not unreasonably affect ground water during the active life of the site.
(d) Subsurface flow into the site and the depth at which water soluble materials are placed shall be controlled during the construction and operation of the site to minimize leachate production and assure that the Group 2 waste material will be above the highest anticipated elevation of the capillary fringe of the ground water. Discharge from the site shall be subject to waste discharge requirements.

CLASS III DISPOSAL SITES

Those sites at which protection to water quality is provided from Group 3 wastes by location, construction, and operation which prevent erosion of deposited material.

Classification as adopted by the California State Water Resources Control Board, March 2, 1972.

Source: Subchapter 15 of the Administrative Code of the State of California adopted March 2, 1972.

EQUIPMENT

The key to a sanitary landfill is the compaction and daily covering of waste. Machine selection plays a critical role in the success of the operation to handle the never-ending stream of waste. Size, horsepower, weight, special accessories, and safety equipment are important factors. With the wide variety of equipment on the market, the wrong choice will cost time and money. Part of any filling operation are the associated tasks including road grading and maintenance, dust control, trenching, service, repair, and other miscellaneous jobs. Each requires equipment specific to the job.

The work horse of most landfills is the crawler tractor. It is especially adept at placing big loads of waste and compacting them at the same time. Track-type tractors can economically excavate cover and bulldoze it about 300 feet or even further when teamed with a towed scraper. These machines have traction to work in all kinds of weather to continue disposal operations year-round. Pioneering cuts, site construction and building access roads are all performed easily with this machine and it has proven versatile for any landfill oepration. Crawler tractors range from 20,000 to 70,000 pounds and are equipped with a U-type landfill blade, blower fan, sealed track and hydraulic system. Other specifications and features vary with the manufacturer.

Similar to the crawler tractor is the crawler loader. In a landfill where only one machine is needed, this one is best suited as it can perform the disposal operation as well as excavate and carry cover material. It is available in a range of sizes depending on the job and manufacturer. Special compactor machines have been designed and built expressly for landfill operations. Landfill compactors are essentially a single-purpose machine which can provide the highest degree of waste compaction. Tests show that 20 to 30 percent greater compaction can be realized over similar sized crawler machines. Greater compaction means extended landfill life. Landfill compactors spread and compact waste dumped from trucks but work best where other machines do the excavating.

Cover operations require towed or self-propelled scrapers. For short hauls, the towed scraper is adequate but longer hauls require a wheel tractor scraper. Elevating scrapers that self load and work alone allow a single operator to provide cover. Other scrapers include a standard self-propelled model which requires a push tractor for loading, and tandem-powered or twin-engine

scrapers that often load without push assist and with all-wheel drive which give traction in wet weather.

Road maintenance is essential in a landfill. Heavy traffic is usually over dirt roads that become rutted, pot-holed and bumpy. A standard motor grader used frequently allows trucks to maneuver without excessive damage to springs, shocks, lights, and an endless list of small maintenance items.Proper grading also allows safe travel within the landfill. Using a water truck on roads to control dust during dry, hot periods maintains safe conditions and an attractive appearance.

Trenching for cover or ditching is best accomplished with a dragline. Sizes are available from one-quarter yard to five yards but the most commonly used is the three-quarter-yard bucket.

Dealers can provide information about specific service and maintenance warranties. The table shown here gives a good idea of the variation in equipment type depending on the size of the operation.

Estimating Machine Sizes Needed

Population Served	Daily Tonnage Produced	Track-Type Tractors	Track-Type Loaders	Wheel-Type* Loaders	Landfill** Compactors
Up to 15,000	Up to 35	D4D	941B	920-930	
10,000-35,000	25-90	D5	951C	950	
25,000-80,000	60-200	D6C	955L	966C	
70,000-110,000	175-275	D7F	977L		
100,000-200,000	250-500	D8H	983		
200,000 & Up	500 & Up	Variety of Machine Combinations			826B

Scrapers are not listed since they are normally only used in conjunction with other types and not as single, independent units.

**Equipped with landfill tires or V-cleat steel wheels.*
***Cat landfill compactors work well with existing equipment. Or when no excavation is required and cover material is stockpiled nearby they can work alone.*

Source: MACHINES FOR SANITARY LANDFILL
CATERPILLER TRACTOR CO.

SANITARY LANDFILL COSTS

Among the costs associated with the waste process, disposal appears as the least expensive element. In the Bay Area, approximately 20 percent of the total bill goes for disposal operations whereas 80 percent is spent for collection and transfer. Many items contribute to the cost of landfill operations but the major investments are land purchase, initial improvements, and equipment financing.

Land cost over a long period includes the initial purchase price of the site, interest charges for long-term financing, and annual property taxes. Collectively, these account for about 13 percent of landfilling costs.

Initial on-site improvements can be substantial. Entrance and roadway grading and paving in canyon sites can amount to $250,000. Scale pits, scales, charge booth, landscaping, office, shop, water system, utilities, fencing, and drainage structures can add an additional $100,000. Directly associated with this construction is the supporting architectural and civil engineering work. Additional professional engineering is necessary to prepare environmental impact statements and the seemingly endless applications required by public agencies.

Since these projects continue many years, new machinery has proven to be most economical. To properly equip a landfill to process a moderate daily volume of waste, an initial bill of $400,000 is not unusual. This investment includes a tractor set-up for disposal operations, a tractor with ripper attachment, a self-propelled scraper for cover operations, a road grader, water truck, service truck, a pick-up truck, and miscellaneous tools and shop equipment. Taxes and vehicle registration fees add to the cost of this equipment.

Equipment is often the highest single expense in a landfill operation. Equipment costs can be divided into two categories. First are investment costs which include delivered purchase with accessories, depreciation or amortization, insurance, interest, taxes, and final resale value. Second are operating costs including fuel, lubricants, grease, filters, tires, tracks, preventive maintenance, and major repairs and overhaul.

The purchase price of landfill equipment varies according to horsepower, size, weight, attachments, safety accessories, and manufacturer. Normal amortization or depreciation is taken over five years or 10,000 hours of machine life, whichever occurs first.

CATERPILLAR MACHINE PURCHASE PRICE (1973)

D4D	Track-type Tractor	$ 28,530
D6C	Track-type Tractor	51,910
D7F	Track-type Tractor	64,520
D8H	Track-type Tractor with Ripper	101,110
955L	Track-type Loader	41,400
977L	Track-type Loader	62,170
983	Track-type Loader	90,100
966C	Wheel-type Loader*	54,600
816	Landfill Campactor	51,950
826B	Landfill Compactor	92,455
627	Wheel Scraper	114,440
631	Wheel Scraper	142,250
12F	Motor Grader	47,500

* Equipped with landfill tires or V-cleat steel wheels.

Prices reflect OSHA safety standards and additional accessories and guarding necessary for sanitary landfill operation. Also included is 5% state sales tax.

Source: PETERSON TRACTOR COMPANY

Typical owning costs for a new D8 tractor costing $101,110 are over $11 per operating hour. For a 627 scraper costing $110,000, hourly owning costs can be as high as $19 per hour because it may only be used three hours a day for covering operations.

Operating costs are equally significant. Fuel consumption ranges from $1 to $3 per hour, depending on the machine type, price of fuels, operator skill, type of wastes processed, terrain and soil conditions. Lubricants, filters, and grease are used continuously in the hydraulic system engine, transmission and final drives, adding to the cost. Tires and crawler tracks will cost another $2 to $4 per hour. But the largest part of the equipment operating cost is the routine maintenance and major periodic overhauls. These alone can average between $7 and $10 per hour.

Actual landfill operating costs include labor, machine operation, utilities, site maintenance and inspection, administration and professional services. Often the dominating operating expense is for wages, especially in metropolitan areas where employees are unionized. In addition, employee insurance, health and welfare benefits, and state employers tax add to labor costs. Often labor costs

SANITARY LANDFILL COST ANALYSIS*

Item	%
LAND Purchase, Interest, Taxes	13.0
CAPITAL IMPROVEMENTS Permits, Road, Scales, Buildings	7.0
EQUIPMENT OWNING Amortization, Tax, License	18.0
LABOR Wages, Health & Welfare, Insurance, Employer Tax	27.0
EQUIPMENT OPERATING Fuel, Oil, Parts, Repair	11.0
SITE MAINTENANCE Roads, Fences, Landscaping	2.0
UTILITIES Water, Power, Phone, Sanitation	0.5
ADMINISTRATIVE Clerical, Overhead, Supervision	4.0
PROFESSIONAL Legal, Accounting, Engineering	1.0
TAXES Local, State, Federal	9.5
PROFIT	7.0
	100.0

*The percents shown were taken from costs developed by Easley & Brassy Corporation for a 300-acre canyon site designed to handle 250,000 tons per year, with an anticipated life of 25 years: total annual cost of project, $415,000; total cost per ton, $1.65.

alone will exceed 25 percent of the landfilling operation.

Continual maintenance of roads, gates, fences, water supply system, and landscape accounts for about 2 percent of costs. Additional expenses are incurred for utilities including water, power, phone, and sanitary services. These costs are minor but essential to the operation.

Administration work includes clerical, billing, office overhead, travel, and supervision. Other necessary services include legal, accounting, and continuous engineering consulting and inspection.

The final summation also includes the amount allocated for business taxes to local, state, and federal governments, and an allowance for business profit.

Landfill operation costs generally range from $1.50 to $4 per ton in inverse relation to the amount of waste disposed. In any case, an economic comparison of sanitary landfill operation with alternate methods shows that landfills are less costly to the citizen who must ultimately pay for waste management.

SANITARY LANDFILL AND THE ENVIRONMENT

Protecting public health and safety is the express reason for operating a sanitary landfill. Without land disposal areas, waste, litter, and garbage would accumulate in city and suburban streets causing untold sickness and epidemics. Concern for public health and the environment have first priority even before a disposal site becomes active and even beyond its completion. Control of vectors and rodents, dust, litter, odors, fires, air pollution, and protection of wildlife, birds, water supply and aesthetics demand attention and solutions.

Gases generated during waste decomposition include nitrogen, hydrogen sulfide, carbon dioxide, and methane. During the first year or so of decomposition, the presence of oxygen minimizes the production of methane. But with time, anaerobic conditions prevail, and carbon dioxide and methane are produced in nearly equal quantities with trace amounts of other gases. The concern for landfill gas arises from the potential hazard of methane gas accumulation and the ability of carbon dioxide to affect the quality of a water supply.

A mixture of 5 to 15 percent methane in air is potentially explosive. Since oxygen is void in a landfill when methane is produced, there is no danger of the fill exploding. However, if this gas moves through the soil and accumulates in structures it may cause explosive conditions. Constructing barriers or providing venting to the atmosphere safely relieves the gas.

The effect of carbon dioxide gas on the ground water is known today mostly in a qualitative rather than quantitative way. Depending on the chemical composition of the water-bearing soil, dissolved carbon dioxide will react with calcium, magnesium, iron, and other alkaline carbonates to form bicarbonates. This will increase the hardness, alkalinity, and total dissolved solids in the water supply. If the soil is deficient in calcium and magnesium, carbon dioxide will dissolve forming carbonic acid which may corrode iron or steel pipes used in wells. The effect of carbon dioxide will vary according to the waste composition, depth and volume of fills, distance to ground water, geochemistry of soil and rates of ground water movement. Impervious barriers and venting systems are used to halt gas migration in many fills.

Another way a poorly constructed landfill can affect ground water quality is by leachate percolation into the underground supply. As water

passes through refuse, it is contaminated both chemically and biochemically by the numerous constituents in waste and is transformed into leachate with characteristics that include a low Ph value, dissolved solids of up to 50,000 ppm, total hardness exceeding 20,000 ppm, BOD and COD many times the strength of domestic sewage, a dark green color, and a very strong odor. Investigation has revealed that leachate is produced by directly dumping into water or because of inundation at a later date. However, in well-planned sanitary landfills with proper drainage and with relatively low annual rainfall as in the Bay Area, leachate will not be produced. In preparing a site for waste disposal, specific attention is needed to locate and seal or divert natural water courses. This will prevent leachate production throughout the project.

The ecological effect of sanitary landfilling is somewhat minimal. Disruption of shelter and food for birds and other wildlife is temporary and these creatures return undaunted after the initial operation has begun. Because the actual landfilling operation is confined to a small portion of the total site, there is still ample space for normal life of native species. Wildlife, including deer, quail, seagulls, squirrels, and hawks live in number throughout sites in the Bay Areea. In some cases, landfills are designed to enhance and improve the environmental surroundings of these species.

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GLOSSARY[1]

Abandoned Vehicles — Automobiles, buses, trucks and trailers that are no longer useful as such and have been left on city streets and other public places.

Acetylene Wastes — Acetylene wastes have been calcined and carbide made from recovered lime.

Actinomycetes — A large group of microorganisms closely related to bacteria, but whose cells show branching and form masses like the fungi, except that the cells are much smaller. Actinomycetes give the characteristic odor of rich earth, are important in giving off-tastes to food and water and are of significance in the stabilization of solid wastes and sewage.

After-Burner — A burner located so that the combustion gases are made to pass through flame in order to remove smoke and odors. It may be attached to, or be separated from, the incinerator proper. (See also Burner, Secondary).

Aerobic Respiration — Oxidation of organic compounds by oxygen. (See also Respiration)

***Air Classification** — Passing shredded solid waste through an air stream to separate light and heavy material.

Aluminum Turnings — Oily aluminum chips produced by machining operations primarily from automotive manufacturing plants. Approximately one fifth of liquids present are oil and water.

Anaerobic Respiration — A type of respiration among some bacteria in which an inorganic oxidant (NO3, SO4) other than oxygen is used. (See also Respiration).

Ashes — Residue from the burning of wood, coal, coke or other combustible materials.

Auxiliary Fuel Firing Equipment — Equipment to supply additional heat, by the combustion of an auxiliary fuel, for the purpose of attaining temperatures sufficiently high to (a) dry and ignite the waste materials, (b) maintain ignition thereof and (c) promote complete combustion of combustible solids, vapors and grease.

Bacteria — Single-celled organisms, microscopic in size, which possess rigid cell walls and when motile have flagella. The cell nucleus is not surrounded by a membrane. There are three major groups — true bacteria, actinomycetes and budding bacteria. Some are capable of causing human, animal or plant diseases. Some are important in refuse stabilization.

Baffle — Any refractory construction intended to change the direction of flow on the products of combustion.

Bagasse — Fibrous residue remaining after sugar juice has been removed from sugar cane stalks.

Becarri Process — Composting process developed by Dr. Giovanni Beccari in 1922. Initial anaerobic fermentation is coupled with a final stage in which decomposition proceeds under partially aerobic conditions.

***BOD** — Biochemical oxygen demand of sewage, industrial waste, leachate or polluted water. It is the amount of molecular oxygen required to stabilize the decomposable matter present by aerobic biochemical action.

Breeching (Flue Connection) — A passage for conducting the products of combustion to the stack or chimney.

Bridge Wall — A partition wall between chambers over which pass the products of combustion (See also Curtain Wall)

BTU — (British Thermal Unit) — The quantity of heat required to increase the temperature of one pound of water from 60° to 61° F.

Bulky Wastes — Large items of refuse, such as appliances, furniture, certain auto parts, trees and branches, stumps, and flotage.

Burner — A device of simple construction used for volume reduction of refuse by burning. Not to be confused with an incinerator, which, properly designed and operated can produce an acceptable emission and residue.

Burner, Primary — A burner installed in the primary combustion chamber to dry out and ignite the material to be burned.

Burner, Secondary — A burner installed in the secondary combustion chamber to maintain a minimum temperature of 1400° F. It may also be considered as an after-burner. (See also After-Burner)

Burning Area (Incinerator) — The horizontal projected area of grate , hearth, or combination thereof, on which burning takes place.

Burning Rate — The amount of wastes consumed usually expressed as pounds per hour per square foot of burning area. Occasionally expressed as BTU per hour per square foot of burning area, which refers to the heat liberated by combustion of the wastes.

Bypass — An arrangement of breechings or flue connections and dampers to permit the alternate use of two or more pieces of equipment by directing or diverting the flow of the products of combustion.

Capacity (Incinerator) — The amount of solid and/or semi-solid wastes that can be burned to an inoffensive gas and a sterile residue, containing little or no combustible material, in a given time period. Usually expressed in pounds per hour or tons per 24 hours.

Carrier — A person who harbors a specific infectious agent in the absence of discernible clinical disease and serves as a potential source or reservoir of infection for man.

Carry-Cloth — A large canvas or burlap cloth square used in transfer of refuse from homes by collectors in backyard carryout service. Serves as a carrying container. (See also Carrying Container)

1 Originallly published in the **1972 Sanitation Industry Yearbook** as "Dictionary of Trade Terms".
* Definitions added by Easley & Brassy Corporation.

Carrying Container — A barrel, can or other receptacle carried by the collector in backyard carryout service. Usually of 30-55 gallon capacity and especially constructed of aluminum.

Catalytic Combustion System — A catalytically active substance, interposed in the exhaust gas stream to burn or oxidize vaporized hydrocarbons or odorous contaminants.

Cell — Compacted refuse completely enveloped by cover material.

Central Garbage Grinding — The grinding by mechanical means of putrescible wastes accumulated by municipal, commercial, or private collection or transfer vehicles.

Checker Work — A pattern of multiple openings in refractory through which the products of combustion pass to promote turbulent mixing of the gases.

Chimney (Stack, Flue) — See Stack

Chute, Charging (Incinerator) — A pipe or duct through which wastes are converted from above to the primary chamber, or to storage facilities preparatory to burning.

***COD** — Chemical oxygen demand of sewage, industrial waste, leachate or polluted water provides a measure of the oxygen equivalent of the organic matter in a sample that is susceptible to oxidation by a strong chemical oxidant.

Cold Drying Hearth — A surface upon which wet wasted materials are placed to dry prior to the burning by the actual hot combustion gases passing only over the wet material.

Combustible Rubbish — Miscellaneous burnable materials. In general the organic component of rubbish.

Combustion Air (Primary) — Air introduced to the primary chamber through the fuel bed by natural induced or forced draft.

Combustion Air (Secondary) — Air introduced above or beyond the fuel bed by natural, induced or forced draft. It is generally referred to as overfire air if supplied above the fuel bed through the side walls and/or the bridge wall of the primary chamber.

Combustion Air (Theoretical) — Amount of air estimated to be required to burn wastes completely, after determining its chemical composition, without use of excess air. Also designated as stoichiometric air.

Combustion Air, Excess — Air supplied in excess of theoretical air, usually expressed as a percentage of the theoretical air. Also called excess air.

Combustion Chamber (Primary) — Chamber where ignition and burning of the wastes occurs.

Combustion Chamber (Secondary) — Chamber where combustible solids, vapors and gases from the primary chamber are burned and settling of fly ash takes place.

Commercial Operator (Ohio's Definition) — All persons, firms or corporations who own or operate stores, restaurants, industries, institutions and other similar places, public or private, charitable or non-charitable, and includes all responsible persons other than householders, upon whose premises putrescible wastes, other refuse or both is, or are, created.

Commercial Refuse — All solid wastes originating in businesses and multiple unit rental structures, such as office buildings, apartment houses, stores, markets, theaters and privately owned hospitals and other institutional units.

Communicable Disease — All illness due to an infectious agent or its toxic products which is transmitted directly or indirectly to a healthy person from an infected person or animal, or through the agency of an intermediate host, vector or inanimate environment.

Communicable Period — The time or times during which the etiologic agent may be transferred from an infected person or animal to man.

Compactor Collection Truck — Enclosed vehicle provided with special mechanical devices for loading the refuse into the main compartment of the body and for compressing and distributing the refuse, within the body.

Composting — A controlled microbial degradation of organic wastes yielding a nuisance-free product of potential value as a soil conditioner.

Construction and Demolition Wastes — Waste building materials and rubble resulting from construction, remodeling, repair and demolition operations on houses, commercial buildings, pavements and other structures.

Containers, Storage (Paper and Plastic Sacks, Disposable) — Storage of disposable sacks made of wet-strength Kraft paper or polyethylene plastic usually 3½ feet high and with a 20 to 35 capacity gallon. Associated hardware includes various types of metal hardware tailored to the sacks. These may be free-standing or affixed to a wall.

Containers, Storage (Reusable, Individual) — Fundamental requirements are that they be watertight, have tight fitting covers and be easy to clean. For rubbish, the containers should be such that the material cannot leak through crevices or be blown from the top. Containers for ashes should be leakproof and fireproof. All containers should be easy to empty and be equipped with suitable handles.

Contamination — Presence of a pathogenic organism on a body surface, or on or in an inanimate article.

Contract Collection — Community, complex or plant pays a contractor for collection work.

Controlled Burning Dump — Refuse trucks are unloaded onto a prepared dirt bank, usually about 12 feet high, with a slope of approximately 40 degrees. The dump operator uses a hook to distribute any piles of refuse evenly and then lights each load on the downwind edge. (See also Open Dump).

Curtain Wall — A partition wall between chambers under which pass the products of combustion. (See also Baffle)

Cut and Fill — A method of disposing of refuse on land without creating

nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, reducing it to the smallest practical volume and covering it with a layer of earth at the conclusion of each day's operation, or at more frequent intervals. The term cut and fill is synonymous with sanitary landfill.

Damper — A manually or automatically controlled device used to regulate the rate of flow of air or other gases.

Dano Biostabilizer System — Aerobic, thermophilic composting process in which conditions of moisture, air and temperature are maintained in a single slowly revolving cylinder that retains the compostable refuse for one to five days. The refuse is later windrowed.

Dead Animals — Those that die naturally or from disease or accidentally killed. Condemned animals or parts of animals from slaughter houses or similar places are not included in this term, but are regarded as industrial refuse.

Definite Working Day Collection Method — A variation of the large route method. Definite routes are laid out and a crew assigned to each. Collection proceeds along a route for the length of time adopted for a working day. The next day, collection begins where the crew stopped the day before. This continues until the route is completely collected, whereupon the crew starts collection again at the beginning of the route, without interruption.

Deglasser — An Osborne Separator used to remove small particles of glass, metal and other products from compost. In addition, it utilizes a pulsed, rising column of air to separate heavy items contained in compost.

Demolition Wastes — See Construction and Demolition Wastes.

***Dense Media Separation** — A separation process of non-ferrous metal from other large particles such as rubber, plastic, bone or leather, using a fluid solution with a specific gravity about twice that of water. The metal fraction sinks in the solution while other material floats.

Detachable Container System — A partially mechanized self-service refuse removal procedure with specially constructed containers and vehicles. It is mechanized in that special equipment is used to empty the containers and haul refuse to the disposal site. It is self-service when the customer deposits the refuse in the container.

Disinfection — Killing of pathogenic agents outside the body by chemical or physical means directly applied.

Disposal Area — A site, location, tract of land, area, building, structure or premises used or intended to be used for partial and/or total refuse disposal.

Domestic Refuse — All those types which normally originate in the residential household or apartment house.

Draft — The pressure difference between the incinerator, or any component part, and the atmosphere, which causes the products of combustion to flow from the incinerator to the atmosphere. **Natural:** The negative pressure created by the difference in density between the hot flue gases and the atmosphere. **Induced:** The negative pressure created by the action of a fan, blower or ejector, which is located between the incinerator and the stack. **Forced:** The positive pressure created by the action of a fan or blower, which supplies the primary or secondary air.

Drop Arch — Any vertical refractory wall supported by arch construction.

Drying Hearth — A surface within the primary chamber upon which wet waste materials are deposited for drying, prior to burning.

Drop-off Bodies — See Roll-off Containers.

Dump — An area where unrestricted unloading of refuse is made, without cover or control. (See also Controlled Burning Dump and Open Burning Dump)

Electrostatic Precipitator — A device attached to incinerators where soot and ash are burned off before smoke is released into the atmosphere. Considered to be an excellent safeguard against air pollution.

Emission — The gases, vapor and particulates that reach the atmosphere from the burning process.

Endemic — The regular occurrence of a fairly constant number of cases of a disease within a given area.

Epidemic — The occurrence in a community or region of a group of illnesses of a similar nature, clearly in excess of normal expectancy and derived from a common or propagated source.

Epidemiology — The study of the causes, transmission and incidence of diseases in communities or other population groups.

Etiological Agent — The pathogenic organism causing a specific disease in a living body.

Excess Air — The air remaining after a fuel has been completely burned, or that air supplied in addition to the theoretical quantity.

Expansion Chamber — Any chamber designed to reduce the velocity of the products of combustion to promote the settling of fly ash from the gas stream.

Face — The working side of a landfill operation.

Fairfield-Hardy Digester — A patented product of Fairfield Engineering Company, Marion, Ohio, which decomposes putrescible wastes, sewage sludge, industrial and other organic wastes by a controlled, continuous aerobic-thermophilic process.

Fermentation — Any energy-yielding oxidation in which the oxidant is organic.

Fixed Packer — An adjunct of a refuse container system which compacts refuse at the site of generation into a pull-on detachable container.

Flue (Chimney, Stack) — A vertical passage for conducting products of combustion into the atmosphere.

Flue Gas Washer or Scrubber — Equipment for removing fly ash and other objectionable materials from the products of combustion by means of sprays, wet baffles, etc. Also reduces excessive temperatures.

Fly Ash — All solids including ash, charred papers, cinders, dusty soot or other partially incinerated matter.

Fly Ash Collector — Equipment for removing fly ash from the products of combustion.

Fomes (Plural, Fomites) — An inanimate object not supporting bacterial growth but serving to transmit pathogenic organisms between humans.

Fomite — See Fomes

Food Waste Disposer — See Garbage Grinding.

Forced Draft — The movement of flue products created by the action of a fan, blower, or ejector which supplies the combustion air above atmospheric pressure.

Franchising — The exclusive right granted a contractor or hauler to collect solid wastes from a district or community, generally conferred by a governing political body.

Front End Loader (Collection) — Detachable container system in which collection vehicle has arms which engage container (usually 1-10 yards capacity), move it up over the cab and empty it into the vehicle body. Container is left with the customer.

Fungi — Simple plants without photosynthetic pigment. The cells have a nucleus surrounded by a membrane, and the cells are connected together in long filaments called hyphae, which may grow together to form a visible body. Simpler fungi are involved in stabilization of solid wastes.

Garbage — Rejected food wastes including waste accumulation of animal, fruit or vegetable matter used or intended for food or that attend the preparation, use, cooking, dealing in or storing of meat, fish, fowl, fruit or vegetable. (Editor's note: **The word "garbage" is often misused to mean non-putrescible wastes.**)

Garbage Grinding — A method of uniformly reducing food waste or putrescibles and placing the reduced product in sewer systems. The reducing device may be a home sink grinder, or a large central grinder which serves industry or the community. It is noted that the ground garbage, which should pass through a sewage treatment plant, must still be disposed of as sewage sludge after treatment.

Gas Scrubber (Washer) — See Gas Washer.

Gas Washer (Scrubber) — Auxiliary equipment designed to remove pollutants in wet form from the products of combustion.

Gases, Incinerator — Combustion gases which may contain water vapor and excess or dilution air added after the combustion chamber.

Gasification — The process or processes whereby solid or liquid matter is converted to such gases as carbon dioxide, methane, or ammonia through biological activity.

Gelling — A process for producing dried pulp for cattle feed from the peelings, cores and trimmings of cannery pear wastes. The sediment is pressed and dried and used as cattle feed.

Grapple — Clamshell-type bucket having three or more jaws. Also called star or orange peel bucket.

Grate — Surface with suitable openings, to support the refuse and permit passage of air through the burning fuel. It is usually located in the primary combustion chamber, and is designed to permit removal of unburned residue, and may be horizontal or inclined and stationary or movable.

Grate, Chain — A stoker which has a moving chain as a grate surface; the grate consisting of links mounted on rods to form a continuous surface that is generally driven by sprockets on the front shaft.

Grate, Dead Plate — A stationary grate through which no air passes.

Grate, Fixed or Stationary — A grate which does not have movement.

Grate, Oscillating — A stoker of which the entire grate surface oscillates to move the refuse and residue over the grate surface.

Grate, Reciprocating — A gate whose sections move continuously and slowly, forward and backward, for the purpose of agitating and also moving the burning refuse material from the charging to the discharge ends of an incinerator furnace.

Grate, Rocking — An incinerator stoker with moving and stationary grate bars which are trunnion supported. In operation, the moving bars oscillate on the trunnions, imparting a rocking motion to the bars, thus agitating and moving the burning refuse and residue.

Grate, Traveling — A traveling grate stoker consists of an endless grate similar to a chain grate, but with grate keys mounted on transverse bars.

Gravity Separation — Concentration or separation by gravity is based on difference in specific gravity and sizes of materials.

Grinder — Equipment for the reduction of solid wastes before depositing in landfill or incinerator.

Grog — Calcined fireclay or clean broken fireclay brick, ground to suitable fineness. It is added to a refractory batch to reduce shrinkage in drying and firing.

Ground Pressure — The weight of a machine divided by the area in square inches of the ground directly supporting it.

Groundwater — That portion of subsurface water which fully saturates the pore spaces of the rock or soil and which behaves in response to gravitational force and occupies the zone of saturation.

Groundwater Flow — Flow of water in an aquifer or soil. That portion of the discharge of a stream which is derived from groundwater.

Groundwater, Free — Groundwater in aquifers not bounded or confined by impervious strata.

Groundwater Runoff — That part of the groundwater which is discharged into a stream channel as spring or seepage water.

Group Task System — A variation of the task collection system in which several trucks start out at limits of assigned routes. A truck crew finishing early helps another that is behind. All work toward a determined completion point. The method is often used in relatively congested areas. Requires more supervision than the task system.

Grouser — A ridge or cleat across a track shoe, which improves its grip on the ground.

Habitable Building — A structure or part thereof in which persons live, sleep, reside, work or congregate.

Hammermill System — A process similar to the rasping system except that a rapidly spinning hammermill shreds the refuse, instead of a slowly turning, rasping machine which serves the same purpose.

Hardpan — Hardened, compacted or cemented soil horizon.

Haul, Barge — The hauling of solid wastes by barge.

Haul Distance — **a.** Distance landfill cover material must be transported to the working face. **b.** Distance collection truck must travel from its last pickup stop to the working face of a landfill or tipping floor of a solid wastes volume reduction or disposal facility. **c.** Distance transfer vehicle must travel from a solid wastes processing station to the point of final disposal.

Haul, Rail — The hauling of solid wastes by rail.

Haul Time — Elapsed or cumulative time spent hauling collected refuse from the route or processing station to the disposal point.

Hazardous Wastes — Includes, but is not limited to , explosives, pathological wastes, radioactive materials and chemicals which are harmful to the public health.

Hearth, Hot Drying — A surface upon which wet material is placed to dry by the action of hot combustion gases that pass successively over the material and under the hearth.

Heat, Available — The quantity of useful heat per unit of fuel available from complete combustion after deducting dry-flue-gas and water-vapor losses.

Heat Balance — An accounting of the distribution of the heat input and output, usually on an hourly basis.

Heat Exchanger — A set of tubes to accomodate exhaust gases with means for passing room air over outside of tubes such that heat of gases is transferred to room air used for heating ventilation air supply to room or process equipment.

Heat of Combustion — The amount of heat, usually expressed at BTU per pound of gas-fired or dry waste, liberated by combustion at a reference temperature of 68° F. With reference to auxiliary gas, it is expressed as BTU per standard cubic foot, and to auxiliary oil as BTU per pound or gallon. Also called heating value.

Heat Release Rate — The amount of heat liberated in the primary combustion chamber, usually expressed as BTU per hour per cubic foot.

Heating Value — See Heat of Combustion.

***Heavy Media Separation** — See Dense Media Separation.

Hog Feeding — A process in which the putrescible wastes portion of refuse is disposed of by feeding to hogs. State regulations throughout the country require that such wastes be heat treated prior to feeding.

Hopper — A chamber or bin used for loading solid fuel or refuse into a packer, mobile or fixed.

Horsepower, Drawbar — Horsepower available to move a tractor and its load, after deducting losses in the power train.

Horsepower, Shaft (Flywheel Or Belt Horsepower) — Actual horsepower produced by the engine, after deducting the drag of accessories.

Host — The living body, human or animal that provides food and shelter for disease organisms.

Hot Drying Hearth — A surface upon which wet material is placed to dry by the action of hot combustion gases that pass successively over the wet material and under the hearth.

Hydraulic Gradient — Change in the hydraulic head per unit distance.

Hydrogen Sulfide — Gas product of the reduction of sulfate, odorous in concentrations as small as parts per billion. Chemical formula H_2S.

Hydrology — Science dealing with the properties, distribution and flow of water on or in the earth.

Hydrolysis — A means of utilizing wood wastes and agricultural residues.

Ignition — The initiation of combustion.

Ignition Temperature — Lowest temperature of a fuel at which combustion becomes self-sustaining.

Impermeable — Resistant to the flow of water or other fluid.

Impervious — Resistant to penetration by fluid.

Impactmill — A grinding machine that operates by impaction of material against heavy metal projections rigidly attached to a shaft rotating at a high velocity.

Incineration — The process of burning solid, semi-solid or gaseous combustible wastes to an inoffensive gas and a sterile residue containing little or no combustible material.

Incinerator — An arrangement of chambers and equipment designed for burning solid, semi-solid or gaseous combustible waste to an inoffensive gas and a sterile residue containing little or no combustible material.

Incinerator, Batch Fed — An incinerator periodically charged with refuse which is allowed to burn out before another charge is added.

Incinerator, Chute Fed — An incinerator which is fed through a charging chute extending two or more floors above the incinerator.

Incinerator, Commercial — A pre-designed, shop-fabricated unit possibly shipped assembled as a package, for general refuse reduction.

Incinerator, Continuous Feed — An incinerator into which refuse is charged in a nearly continuous manner so as to maintain a steady rate of burning.

Incinerator, Direct Fed — An incinerator that is charged through a shaft that also functions as a flue to carry the products of combustion.

Incinerator Gases — Combustion gases which may contain water vapor and excess or dilution air added after the combustion chamber.

Incinerator, Industrial — A specifically designed, site-erected unit for disposal of a particular industrial waste.

Incinerator, Multiple Chamber — An incinerator consisting of two or more refractory-lined chambers, interconnected by gas passage ports or ducts and designed in such a manner as to provide for complete combustion of the material to be burned. Depending upon the arrangement of the chambers, multiple-chamber incinerators are designated as in-line or retort types.

Incinerator, Municipal or Urban — A specifically designed, site-erected unit for disposal of refuse collected from residential, commercial and industrial sources.

Incinerator, Residential — A pre-designed, shop-fabricated unit, shipped assembled as a package, for individual dwellings.

Incinerator, Retort Type — A Multiple chamber incinerator in which the gases return from the end of the ignition chamber through the mixing and combustion chamber located beside the ignition chamber.

Incinerator, Single-Chamber — A refractory-lined, cylindrical furnace charged through a door in the upper part of the chamber. Refuse is batch fed periodically.

Incubation Period — The time interval between the infection of a susceptible person or animal and the appearance of signs or symptoms of the disease.

Indore Process — Anaerobic composting method originating in India in the 1920's. Organic wastes such as putrescibles, straw and leaves are placed in alternate layers with night soil, sewage sludge or animal manure into pits or trenches 2-or-3-feet-deep, or piled on open ground to a height of about five feet. Pile is turned twice in six months; drainage is used to keep compost moist. The Van Mannen process is a recent modification.

Induced Draft — The movement of flue products created by the action of a fan, blower or ejector, which is located between the incinerator and the stack, or at the stack exit.

Industrial Refuse — All solid wastes which result from industrial processes and manufacturing operations, such as factories, processing plants, repair and cleaning establishments, refineries and rendering plants.

Infection — The entry and development or multiplication of a particular pathogen in the body of man or animal.

Infiltration — The downward entry of water into soil.

Infiltration Air — Air that leaks into the chambers or ducts of an incinerator.

Influent Stream — Stream or portion of stream that contributes water to the groundwater supply.

Insulating (Back-Up) Block — A shaped product having a very low thermal conductivity and a bulk density of less than 70 pounds per cubic foot, suitable for lining industrial furnaces.

Interflow — That portion of rainfall which infiltrates into the soil and moves laterally through the upper soil horizons until intercepted by a stream channel or until it returns to the surface at some point down slope from its point of infiltration.

Intermittent Stream — Channel in which water flows periodically.

Isotropic Soil — Soil having the same property or properties, such as permeability, in all directions.

Junk — Old or scrap copper, brass, rope, rags, batteries, paper, rubber, junked, dismantled or wrecked automobiles or parts thereof; iron, steel and other old or scrap ferrous or non-ferrous materials which are not held for sale for remelting purposes by an establishment having facilities for processing such materials.

Junk Collector — Accepts discarded materials, brings them to his yard and sorts them. He does not process these materials to any degree but offers them for sale to processors.

Knife Hog — A size-reduction device relying primarily on the shearing, cutting or chipping action produced by sharp-edged blades attached to a rotating shaft (mandrel) to shave or chip off pieces of the charged object.

Landfill — An area or site of controlled unloading of refuse where an earth cover is applied at unstated intervals.

Landfill Machine — Any machine that is used on a sanitary landfill; but generally considered to be dozers, tractors, loaders, compactors, and/or scrapers.

Lantz Process — A destructive distillation process in which combustible fractions of solid wastes are converted to combustible gas, charcoal and a variety of distillates.

Large Route Collection Method — Variation of the task system in which work is laid out for a normal week's activity for a single crew. The crew may work each day without a fixed stopping point or number of hours, but the route must be entirely completed within the working week.

Leachate — Liquid emanating from a land disposal cell that contains dissolved, suspended and/or microbial contaminants from the solid wastes.

Ledge Plate — A form of plate which is adjacent to, or overlaps the edge of a stoker.

Levee — A bank of material, usually earth, constructed to form a barrier. Also called a dike.

Lift and Carry Container — Detachable container system in which service vehicle has lifting arms which pick up container and contents together for transportation to disposal site.

Lift, Crane — Maximum safe vertical distance through which a crane bucket can move.

Lift Depth — Vertical thickness of a compacted volume of solid wastes and the cover material immediately above it in a sanitary landfill.

Lining — The material used on the inner face of a furnace wall. It is usually of high-grade refractory tile, brick or plastic.

Litter — Solid wastes that are scattered about in a careless manner.

Load-Bearing Resistance — The resistance of a refractory to deformation when subjected to a specified compressive load at a given temperature for a certain period of time.

Loader, Batch — A type of enclosed compactor truck equipped with a loading hopper at the rear and a large mechanized panel which sweeps the solid wastes into the body of the unit.

Loader, Bucker — A type of enclosed compactor truck that is equipped with a low trough (about 36" above the ground) into which solid wastes are placed prior to being raised and dumped into an opening in the top of the vehicle.

Loader, Escalator Conveyor — A type of enclosed compactor truck that has an arrangement for elevating the refuse materials into the body by means of a continuous conveyor.

Loader, Movable Bulkhead — A type of side-loading, enclosed compactor truck equipped with a movable bulkhead that pushes the solid wastes from the front loading area to the rear of the vehicle.

Loam — A soft, easily worked soil, containing seven to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand, according to USDA classification.

Lysimeter — A device for measuring the quantity or rate of water movement through or from a block of soil, usually undistributed and in its original place, or for collecting such percolated water for quality analyses.

Manometer — A U-shaped or inclined tube filled with a liquid, used to determine pressure differences of gases, vapors or liquids.

Manual Burner — A burner which is purged, started, ignited, modulated and stopped manually.

Material Balance — An accounting of the weights of material entering and leaving a process, such as an incinerator, usually made on a periodic basis.

Maximum Emission Concentration —Standards for maximum concentration of air pollutant emission from stationary or moving sources, including opacity standards, such as the Ringelmann Chart gradation often applied with time specification; gravimetric emission standards (expressed as weight of emitted pollutant and volume or unit weight of standards (percent of gaseous pollutant by volume in the emitted gas or as parts per volume in specific parts of effluent gas).

Mechanical Collector — A device that separates dust in a dry state from gas through the application of inertial and gravitational forces.

Mechanical Method — A composting procedure characterized by continuous mechanical mixing and forced aeration. Also called High Rate Composting and Continuous-Mix Composting.

Metals — In the secondary materials industry, includes all nonferrous materials, copper, brass, aluminum, zinc, lead, but not iron and steel.

Methane — An odorless, colorless, non-poisonous and explosive gas.

Micron — A measure equal to 1/1,000th of a millimeter or 1/25,400th of an inch used to identify dust-particle sizes.

Microorganisms — Generally any living things microscopic in size, including the bacteria, actinomycetes, yeasts, simple fungi, some algae, rickettsiae, spirochetes, slime molds, protozoans and some of the simpler multicellular organisms Some produce disease in man, animals or plants; some are involved in stabilization of solid wastes and sewage.

Mixing Chamber — A chamber, usually between the primary combustion chamber and the secondary combustion chamber of the incinerator where thorough mixing of the products of combustion and air is accomplished by turbulence created by increased velocities of the gases, checker-work and/or turns in direction of the gas flow.

Moisture Content of Refuse — The weight loss resulting from drying a sample to constant weight under standard conditions, tentatively 75°C for refuse.

Moisture Holding Capacity — The quantity of water held by compacted solid wastes beyond which the application of additional water will cause it to drain rapidly to underlying material.

Moisture Penetration — The depth to which moisture penetrates following irrigation or rainfall before the rate of downward movement becomes negligible.

Monolithic Lining — A refractory lining in incineration or construction made on-site in large sections without the conventional layers and joints associated with brick construction. It may be formed by casting, gunniting, ramming or sintering a granular material into place.

Monorail Crane — A crane consisting of a lifting unit that hangs from a suspended, horizontal rail in such a way that the unit can travel the length of the rail.

Mortar, Air-Setting Refractory — A finely ground refractory material which forms a wet mortar that will upon drying, develop a strong air-set bond between refractory shapes and maintain such bond when heated to working-furnace temperatures. Also called Cold-Setting Refractory Mortar.

Mortar, Fireclay — A clay-and-water mortar of high-fusion-point fire often used for filling joints to stop air or gas leakage without forming a strong bond.

Mortar, Heat-Setting Refractory — A mortar in which the bond is developed by relatively high temperatures as a result of vitrification of part of its constituents. Also called Hot-Setting Refractory Mortar.

Mortar, Hydraulic-Setting Refractory — A mortar that hardens or sets as a result of hydration, a chemical reaction with water. As working-furnace temperature is applied, the water evaporates and a ceramic bond develops.

Multicyclone Collector — A dust collector consisting of a number of cyclones, operating in parallel, through which the volume and velocity of gas can be regulated by means of dampers in order to maintain efficiency over the load range.

Multi-Purpose Bucket — A two-piece, hinged container affixed to movable arms of a loader used to haul, excavate and spread cover material and crush and spread solid wastes.

Municipal Collection — Collection of solid wastes by a city-operated agency.

Natural Draft — The pressure difference created by stack or chimney due to its height and the temperature difference between the flue gases and the atmosphere.

Nitrogen Oxide (NO) — A gaseous compound formed from atmospheric nitrogen and oxygen whenever anything is burned. It normally breaks down into oxygen and nitrogen except when cooled suddenly from a high temperature.

O2 Recorder — An instrument for continuously monitoring the percentage of oxygen content of flue gases.

Noncombustible Rubbish — Miscellaneous refuse materials that are unburnable at ordinary incinerator temperatures (1300° F. to 2000° F).

Obsolescence Scrap — Any scrap resulting from catastrophes, wearing out and obsolescence. In the secondary materials industry, iron and steel only.

Odorant — A gaseous emanation which is offensive or objectionable to the olfactory senses.

Ocean Disposal — A sea dumping process which has been used extensively in the past, but which lost considerable popularity after the U.S. Supreme Court in 1933 outlawed dumping off the New Jersey shore by the City of New York.

Odor Threshold — The lowest concentration of an odor in air that can be detected by a human without the aid of mechanical instruments.

Offal — Intestines and discarded parts from the slaughter of animals.

On-Site Disposal — Includes all means of disposal or, more usually, volume reduction of refuse on premises before collection. Examples are refuse grinding, burning or incineration, burial, compaction or slurrying at homes and commercially-established locations.

Opacity Rating — The apparent dimming of an observer's vision to a degree equal to the apparent dimming quality of smoke of a given rating on the Ringlemann Chart.

Open Burning — Uncontrolled burning of solid wastes in the open or in a dump.

Open Dump — The consolidation of wastes from one or more sources at a central disposal site which has little or no management or control. Problems associated with open dumps include vector breeding, air and water and ground pollution, unsightliness, wasted land, odors, disease and accident potentials.

Open-Pile Method — Open-air composting, either anaerobic or aerobic, accomplished by placing compostable material in windows, piles, ventilated bins or pits and turning it occasionally. Also called Windrow Method.

***Optical Sorting** — The use of photo cells to individually measure the reflectance of passing glass particles.

Organic — Materials containing carbon which oxidize or burn easily and, when they contain nitrogen or sulfur—or both—give off odorous by-products.

Organic Acid — A product of biochemical activity containing the carboxyl group which readily reacts with other compounds.

Organic Content — Synonymous with volatile solids except for small traces of some inorganic materials such as calcium carbonate, which loses weight at temperatures used in determining volatile solids.

Orsat — An apparatus for analyzing gases volumetrically.

Osborne Separator — Device to effect the efficient removal from compost of small particles of glass, metals and other products. Utilizes a pulsed rising column of air to separate heavy items contained in compost. Also called a deglasser.

Overfire Air — Air introduced above or beyond the fuel bed by natural, induced, or forced draft. Generally, it is supplied above the fuel bed through the side walls and/or the bridge wall of the primary chamber. Also known as Secondary Combustion Air.

Overfire Air Fan — A fan used to provide air to the combustion chamber above the fuel bed.

Oxidation — Loss of electrons from an atom or molecule.

Packer — There are two types: a compactor collection vehicle and a stationary packer. A compactor collection truck is an enclosed vehicle provided with special mechanical devices for loading the refuse into the main compartment of the body and for compressing and distributing refuse within the body. A stationary compactor is an adjunct of a refuse collection system which compacts refuse into a pull-on detachable container at the site of generation.

Pan — A scraper capable of carrying a load of soil.

Panel Spalling Test — A standardized test to provide an index to the spalling behavior of refractories.

Paint Sludge — Sticky mass of paint wastes, usually spray-booth residue. Its consistency is that of modeling clay. It has been burnt in pit incinerators but may be an air pollution problem if its contents are highly solid.

Particle — A small, discrete mass of solid or liquid matter, including aerosols, dusts, fumes, mists, smokes and sprays.

Particle Concentration — Concentration expressed in terms of number of particles per unit volume of air or other gas. (Note: On expressing particle concentration, the method of determining the concentration should be stated; that is, number/volume or weight/volume).

Particle Size — An expression of the size of liquid or solid particles expressed as the average or equivalent diameter.

Particle Size Distribution — The relative percentage by weight or number of each of the different size fractions of particular matter.

Particulate Matter — Any liquid or solid which is so finely divided as to be capable of becoming windblown or suspended in air or gas.

Pathogen — Any infective agent capable of producing disease; may be a virus, rickettsia, bacterium or protozoan.

Peep Door — A small door usually provided with a shielded glass opening through which combustion may be observed.

Peep Hole — A small observation port with cover on an incinerator door.

Perched Water Table — The top of a zone of saturation that lies on an impermeable horizon above the level of the general water table in the area. It is generally near the surface and frequently supplies a hillside spring.

Percolation — A qualitative term applying to the downward movement of water through soil.

Permeability — The quality or state of a porous medium relating to the readiness with which it conducts or transmits fluids.

Picking Table (or Belt) — Table or belt at which solid wastes are sorted by removing certain items. Normally associated with composting and salvage operations.

Pitot Tube — An instrument which will sense the total pressure and the static pressure in a gas stream. It is used to determine gas velocity.

Plastic Insulation — Insulation plastic enough when mixed with water to adhere to outer furnace walls of incinerator or to be placed over arches.

Plasticity Soil — Property of soil which allows it to be deformed without appreciable volume change or cracking.

Pneumatic Ash Handling — A system of pipes and cyclone separators which conveys fly ash or floor dust in the air stream to a bin.

Pollutants — Any solid, liquid or gaseous matter which tends to pollute the environment.

Pollution — The presence in a body of water, soil or air of substances of such character and in such quantities that the natural quality of the body (water, soil or air) is degraded so it impairs the body's usefulness or renders it offensive to the senses of sight, taste or smell.

Polyvinyl Chloride (PVC) — A common plastic material (general formula $CH2 = CHC1$) which releases hydrochloric acid (HCI) when burned.

Porosity — Ratio of the space in any porous material (such as soil) that is not filled with solid matter to the total space occupied, generally expressed as a percentage. The porosity of an aquifer is equal to the sum of the specific yield and the specific retention.

Power Pressing — The forming of refractory brick shapes in molds, by means of high pressure applied vertically, from ground refractory material containing an optimum amount of added water.

Premises — A tract or parcel of land with or without habitable buildings.

Pressure — Total load or force acting upon a surface, expressed as a weight per unit area, such as pounds per square inch (psi).

Primary Air — Air supplied through or adjacent to the fuel bed for the purpose of promoting combustion of the combustible materials in the fuel bed. Also air mixed with the gas prior to combustion at the burner.

Primary Combustion Chamber — Chamber within an incinerator where primary ignition and burning of the wastes occurs.

Private Collection — The collecting of solid wastes for which citizens or firms, individually or in limited groups, pay collectors or private operating agencies. Also known as private disposal.

Problem Wastes — Bulky wastes, dead animals, abandoned vehicles, construction and demolition wastes, industrial refuse, tree debris, evictions (debris of no value) and fly ash.

Processing of Wastes — That which is done to convert any solid waste into something useful, leaving the term "handling" to describe what is done to prepare it for disposal.

Pull-On Container — Detachable container system in which larger container (around 20-30 cubic yards) is pulled onto a service vehicle or tilt frame or hoist truck by mechanical or hydraulic means and carried to disposal site for emptying.

Pulveration — The crushing, grinding, or shredding of material as refuse to a small size.

Putrescible — Capable of being decomposed by microorganisms with sufficient rapidity as to cause nuisances from odors and gases. Kitchen wastes, offal and dead animals are examples of putrescible components of solid wastes.

Putrescine — In biochemistry, a colorless, ill-smelling ptomaine, $C4H2N$ resulting from the bacterial decomposition of animal tissues in the presence of moisture and heat, but in the absence of air.

* **Pyrolysis** — A special high-temperature incineration process conducted in the absence of oxygen, producing solid carbon residue, a low-grade fuel oil, and a low BTU gas.

Pyrometer — An instrument for measuring and recording temperatures.

Radiation Pyrometer — A device

which determines temperature by measuring the intensity of radiation from a heat-generating body.

Railhaul — The hauling of solid wastes by rail.

Rasping Machine — A grinding machine consisting of a large vertical drum containing heavy hinged arms which rotate horizontally over a rasp and sieve floor.

Rasping System — A composting procedure in which refuse is ground through a screen partly covered with steel pins, that have the effect of a rasp. Compost piles are turned during a three to six week period. Developed in the Netherlands in 1951.

Rated Load — The maximum load which a crane is designed to handle safely.

Rear Loader, Detachable Container — Detachable container system in which roll-out containers, typically 1 to 3 yard capacity are hoisted at the rear of the collection vehicle and mechanically emptied. Container is left with the customer.

Reciprocating Grate — A grate whose sections move forward and backward, for the purpose of agitating and moving the burning refuse material from the charging to the discharge ends of an incinerator furnace.

Reduction (In Chemistry) — Addition of electrons to an atom or molecule.

Reduction (Of Refuse) — A process of salvaging fats and oils from refuse by cooking, followed by extraction with solvents and separation from the solvents by distillation.

Refractory (Refractories) — Nonmetallic substances capable of enduring high temperatures used in linings of furnaces. While their primary function is resistance to high temperatures, they usually are called upon to resist one or more of the following destructive influences: abrasion, pressure, chemical attack, and rapid changes in temperatures.

Refuge — A hiding place or shelter for rodents, mice and insects.

Refuse — Putrescible and nonputrescible solid wastes, except body wastes and including kitchen discards, rubbish, ashes, incinerator ash, incinerator residue, street cleanings and solid market and industrial wastes.

Refuse Fill — A systematic and periodic operation conducted to compact and cover refuse, on less than a daily basis.

Refuse Handling — What is done to prepare refuse for disposal as distinguished from "processing" which is conversion of wastes into something useful.

Refuse, Residential — All those types of solid wastes that normally originate in the private home or apartment house. Also called Domestic or Household Refuse.

Refuse Shed — A region or area which for reasons of typography, contiguous population or other common features includes refuse sources which may be considered collectively in general planning. Usually synonymous with a general populated or metropolitan area, and not necessarily limited by lines of political jurisdiction or divisions.

Refuse, Street — Wastes materials picked up by manual or mechanical sweeping of streets and sidewalks, litter from public receptacles and dirt removed from catch basins.

Refuse Train — A number of open detachable type containers or carts hitched in series and pulled by a motor vehicle, purpose to collect solid wastes. Carts can be emptied into a compactor truck or towed directly to the disposal site.

Reheater — Heat transfer apparatus for heating steam after it has given up some of its original heat in doing work.

Reinjection — Recycling of fly ash to the furnace where it is injected for complete burnout of all remaining combustibles.

Rendering — A process of salvaging fats and oils, animal feed and other products from animal waste by cooking. Dead animals, fish and wastes from slaughter houses and butcher shops are commonly used.

Reservoir of Infection — Man, animal, plants, soil or inanimate organic matter in which an infectious agent lives and multiplies and depends primarily for survival, reproducing itself in such manner that it can be transmitted to man. Man himself is the most frequent reservoir of infectious agents pathogenic for man.

Residue — Solid materials remaining after burning, comprising ash, metal, glass, ceramics and unburned organic substances.

Resistance, Body — The sum total of body mechanisms which place barriers to the progress of invasion of pathogenic organisms.

Respiration — Any energy-yielding oxidation in which the oxidant is an organic compound. Oxygen need not be involved, though it is the most common oxidant.

Ringelmann Chart — A printed or photographically reproduced series of four shades of gray, by which density of smoke emissions from an incinerator may be estimated. A clear stack is recorded as 0 and 100 percent black smoke as 5. No. 1 smoke is 20 percent dense, No. 2 40 percent dense, No. 3, 60 percent dense; No 4, 80 percent dense.

Rocking Grate — An incinerator stoker with moving and stationary grate bars which are trunnion supported. In operation, the moving bars oscillate on the trunnions, imparting a rocking motion to the bars, thus agitating and moving the burning refuse and residue.

Roll Bar — Steel protection over the cab of a tractor or loader to prevent injury to the operator.

Roller Crusher — A machine whose function it is to crush material between two opposing steel rollers that rotate slowly on horizontal axes.

Rubbish — Nonputrescible solid wastes, including ashes, consisting of both combustible and noncombustible materials such as paper, cardboard, tin cans, yard clippings, wood, glass, bedding, crockery or litter of any kind.

Rubbish Chute — A pipe, duct or trough through which wastes materials are conveyed by gravity from the upper floors to a storage area preparatory to burning or compaction.

Rubbish, Combustible — Miscellaneous burnable materials. In general, the organic component of rubbish.

Rubbish, Noncombustible — Miscellaneous refuse materials that are unburnable at ordinary incinerator temperatures (1300° F-2000° F.).

Rubbish, Yard — Prunings, brush, grass, clippings, weeds, leaves and general and garden wastes.

Rubble — Broken pieces of masonry and concrete.

Runoff — The portion of precipitation or irrigation water which is returned to the stream as surface flow.

Salvage — Solid wastes materials that are reusable.

Salvaging — The controlled removal of reusable materials.

Salvage and Reclamation — A refuse disposal process in which the material is segregated mechanically or by hand into various categories such as ferrous and nonferrous metals, rags, cardboard, paper and glass. The sorted refuse is then sold as waste or scrap.

Sand — Soil particles ranging from 0.05 to 2.0 mm in diameter, according to USDA classification. Soil material containing 85 percent or more particles of this size.

Sanitary Landfill — A method of disposing of refuse on land without creating nuisances or hazards to public health or safety, by utilizing the principles of engineering to confine the refuse to the smallest practical area, to reduce it to the smallest practical volume and to cover it with a layer of earth at the conclusion of each day's operation or at more frequent intervals.

Sanitary Landfill (Area Technique) — A method of operating a sanitary landfill where refuse is deposited on the ground level or upon an earlier lift of solid wastes.

Sanitary Landfill (Canyon Technique) — An area method of operating a sanitary landfill in a depression where cover material is obtained within the depression.

Sanitary Landfill (Quarry or Pit Technique) — An area method of operating a sanitary landfill in a depression where cover material generally is obtained from without the depression.

Sanitary Landfill (Ramp Technique) — An area method of operating a sanitary landfill where cover is obtained by excavating in front of the working face toe.

Sanitary Landfill (Trench Technique) — A method of operating a sanitary landfill where a trench is excavated specifically for placement of solid wastes and the excavated soil is used as cover material.

Sanitary Landfill — (Wet or Low-Lying Area Technique) — A method of operating a sanitary landfill in a swampy area where precautions are made to avoid water pollution before proceeding with area landfill.

Sanitation — The control of all those factors in man's physical environment which exercise or may exercise a deleterious effect on his physical development, health and survival.

Sanitation Industry Yearbook — An annual publication providing detailed information about most of the products manufactured in North America for the solid wastes management industry.

Saturate — To fill all the voids in a material with fluid; to form the most concentrated solution possible under a given set of physical conditions in the presence of an excess of substance.

Saturated Flow — Flow of water through a porous material under saturated conditions.

Scarify — To disturb or break up the natural soil at a borrow area or sanitary landfill.

Scavenger — One who is occupied in the uncontrolled picking of materials at a dump. Also, a term to describe an independent solid wastes collector used in certain sections of the United States. It is becoming an obsolete expression.

Scavenging — The uncontrolled picking of materials.

Scooter — A small, usually single-passenger, three-wheeled vehicle with body of 1 or 1½ cubic-yard capacity, used especially to negotiate long driveways and narrow alleys. Collected refuse is emptied into a larger mother truck. Some scooters have dump bodies; others have a stationary bed which holds carry-cans.

Scrap — In the secondary materials industry, applies to iron and steel scrap only.

Scrap, Home or Revert — Scrap which never leaves its home plant but is reprocessed instead.

Scrap, Prompt Industrial — Scrap that is left over from the production of new iron and steel.

Scraper — A pneumatic towed or self-powered wheel machine that pushes earth into a large bin. When used to excavate, haul and spread soil, it may be equipped with a series of flights.

Screen, Rotary — An inclined, cylindrical screen capable of rotating on its axis and sifting solid wastes which are placed in the upper end of the cylinder.

Screen, Vibrating — An inclined screen capable of being vibrated by mechanical means and thereby sifting solid wastes placed on it.

Scrubber , Flue Gas — Equipment for removing fly ash and other objectionable materials from the products of combustion by means of sprays, wet baffles, etc. Also reduces excessive temperatures.

Secondary Air — Any air, controlled with respect to quantity and direction, supplied beyond the fuel bed, as through ports in the walls, or bridge wall of the primary combustion chamber, for the purpose of completing combustion of combustible materials in the gases from the fuel bed, or to reduce operating temperature within the incinerator.

Secondary Combustion Chamber — Chamber where unburned combustible materials from the primary chamber are completely burned.

Secondary Materials — Those materials which might go to waste if not collected and processed for refuse. Includes scrap, metals, waste and junk.

Seepage — Movement of water through soil without formation of definite channels.

Semi-Grouser — A crawler track shoe with one or more low cleats.

Separator, Ballistic — A device that drops mixed refuse onto a high-speed rotary impeller so that materials of different physical characteristics are hurled off at different velocities and subsequently land in several separate collecting bins.

Separator, Inertial — A device that relies on ballistic or gravity separation of materials having different physical characteristics.

Separator, Magnetic — Any device that isolates and removes metals by means of magnets.

Service Stop — Residence, commercial and industrial establishment or other living or business unit receiving periodic refuse collection.

Setout, Setback Method — Full refuse containers are carried by a special set-out crew from back doors or other places on the householder's premises to curbs or alleys a few minutes before the collection vehicle arrives. After the refuse is loaded into the collection vehicle, a special set-back crew returns the empty cans to their regular locations within a short time after they are emptied. Also known as Backyard Service.

Settlement — A uniform subsidence of material.

Settlement, Differential — A subsidence of material that is not uniform throughout the plane of the material.

Settling Chamber — Any chamber designed to reduce the velocity of the products of combustion to promote the settling of fly ash from the gas stream. Also known as an Expansion Chamber.

Settling Velocity — The velocity at which a given dust will fall out of dust-laden gas under the influence of gravity only. Also known as Terminal Velocity.

Sewage Sludge — A semiliquid substance consisting of suspended sewage solids combined with water and dissolved materials in varying amounts.

Sewage Treatment Residues — Coarse screenings, grit and dewatered or air-dried sludge from sewage treatment plants and pumpings of cesspool or septic tank sludges which require disposal with putrescible wastes.

Shears — A size-reduction machine that operates by cutting material between two large blades.

Sheepsfoot Roller — A roller that consists of a steel drum fitted with projecting "feet."

Shovel-Off — Any collection vehicle lacking a mechanical emptying device and which must be unloaded by hand.

Shovel-Up — Refuse which is not stored in containers for collection and must be laboriously hand loaded with forks or shovels into a carrying container or collection vehicle.

Shredder, Automobile — A machine that chews up discarded automobiles, small trucks and other ordinarily low-grade sheet and coated scrap in continuous operation, producing premium-grade first-sized pieces that are 99 percent steel.

Shrinkage — Presence of cracks or voids in cover material, primarily a result of loss of moisture.

Side-Loader, Detachable Container — Detachable container system similar to rear loader except loaded at side of collection vehicle.

Silica — The oxide of silicon, formula for which is SiO_2, a major constituent in fireclay refractories, alone or in chemical combinations.

Silicon Carbide — A refractory material of high melting point, high density and high thermal conductivity and having a high resistance to abrasion. Formula: SiC.

Single Load Collection Method — A variation of the task system in which areas or routes are laid out which under normal conditions each crew usually has two or more such routes for a day's work. The crew quits for the day when the assigned number of routes is completed.

Slag — A liquid mineral substance formed by chemical action and fusion at furnace-operated temperatures.

Slagging of Refractories — Destructive chemical action upon refractories at high temperatures resulting in the formation of slag. Also the coating of refractories by ash particles, which form a molten or viscous slag on the refractories.

Slope — Degree of deviation of a surface from the horizontal, usually expressed in percent or degrees.

Slops — Semi-liquid wastes material consisting of putrescible solids and free liquids. Also known as swill.

Slough — Wet or marshy area.

Smoke — An aerosol consisting of all the dispersible particulate products from the incomplete combustion of carbonaceous materials entrained in flue gas as gaseous medium.

Smoke Alarms — Instruments that provide an objective method of continuous measurement and recording of smoke density by measuring the amount of light obscured by smoke when a beam of light is shone through the smoke in a flue. Most of the instruments have on them a scale, graded according to Ringelmann shades. They can be fitted with an alarm that operated when the smoke is above a preset density.

Smoke Density — The amount of solid matter contained in smoke and often measured by systems that relate the grayness of the smoke to an established standard.

Smoke Eye — A device consisting of a light source and photo-electric cell which measures the light obscuration of smoke in flue gas.

Soil — Natural body, developed from weathered minerals and decaying organic matter, covering the earth; the upper layer of the earth in which plants grow.

Soil Erosion — Detachment and movement of the soil from the land surface by wind or water, including normal and accelerated erosion.

Soil, Isotropic — Soil having the same property or properties, such as permeability, in all directions.

Soil, Tight — Soil that is relatively impermeable to water movement.

Solid Wastes — Useless, unwanted or discarded solid materials with insufficient liquid content to be free flowing. Trash, garbage, rubbish.

Solid Wastes Agricultural — Principally the manures and crop residues from various agricultural pursuits, including dairying and the raising of livestock and poultry.

Solid Wastes, Commercial — All solid wastes which originate in business such as office buildings, stores, markets, theatres and privately owned hospitals and other institutional buildings.

Solid Wastes, Industrial — All solid wastes which result from industrial processes and manufacturing operations such as factories, processing plants, repair and cleaning establishments, refineries and rendering plants.

Solid Wastes, Institutional — Solid wastes, originating from institutions such as schools, hospitals, research institutions and public buildings.

Solid Wastes Management — Conduct of the operations of collecting and disposing of refuse by all manner and means known to the industry, both by municipal agencies and private enterprise.

Solid Wastes Management Magazine — A monthly magazine devoted to the refuse industry, both private and municipal, published in the Unites States since 1958.

Soot — Agglomerations of particles of carbon impregnated with tar formed in the incomplete combustion of carbonaceous materials.

Spark Arrester — A device to prevent sparks, embers or other ignited material above a given size from being expelled into the atmosphere, usually from an incinerator.

Special Wastes—Hazardous wastes by reason of their pathological, explosive, radioactive or toxic nature.

Stack (Chimney, Flue) — A vertical passage for conducting products of combustion to the atmosphere.

Stack Effect — The phenomenon of vertical movement of hot gases in a stack because of the temperature (density) difference between the gases and the atmosphere.

Stack Sampling — Collection or representative samples of gaseous and/or particulate matter flowing through a duct or stack.

Standard Air — Dry air weighing 0.075 pounds per cubic foot at sea level (29.92 inches barometric pressure) and 70°F.

Stationary Packer — An adjunct of a refuse container system which compacts refuse at the site of generation into a pull-on detachable container.

Sterilization — Destruction of all micro-organisms and their spores outside of the body by chemical or physical means.

Stoichiometric Air — An amount of air estimated to be required to burn wastes completely, after determining their chemical composition, without the use of excess air. Also known as Combustion Air (Theoretical).

Stoker, Incinerator — A mechanically operable moving grate arrangement for supporting, burning and transporting the refuse in a furnace and discharging the residue. A mechanical stoker for the burning of refuse in an incinerator.

Street Refuse — Material picked up by manual and mechanical sweeping of streets and sidewalks, litter from public litter receptacles and dirt removed from catch basins.

Subsidence — Settlement or sinking to a lower level.

Subsoil — That part of the soil beneath the topsoil, usually not having an appreciable organic matter content.

Sulfur, Oxides of — Compounds of sulfur combined with oxygen. Those of significance in air pollution include sulfur dioxide (SO_2) and sulfur trioxide (SO_3).

Surface Compaction — Molding together and collapse of structure of surface soil when subjected to pressure.

Surface Cracking — Creation of discontinuities in the cover material of a sanitary landfill as a result of settlement and decomposition of solid wastes and/or a change in moisture content of the cover material which may result in exposure of solid wastes, entrance or egress of vectors and entrance of water.

Surface Drains — Surface channels which primarily remove surface water from land.

Surface Dump — Same as Open Dump.

Surface Water — A body of water whose top surface is exposed to atmosphere includes a flowing body as well as a pond or lake.

Swelling, Soil — Physical expansion of the soil mass usually caused by an increase in moisture content in an expanding type of clay.

Swill (Slops) — Semi-liquid wastes material consisting of putrescible solids and free liquids.

Task System)Daily Route Method) — A collection crew is assigned a weekly route, divided into daily areas. The crew is then responsible for refuse pickup at all collection points on the assigned daily routes. Weather, refuse quantities and other variables will cause the elapsed time for completion of each daily route to vary. The crew is allowed to go home after completion of the day's route, whether it takes less or more than the established work day to complete. (See also Large Route Collection Method, Group Task System, Single Load Collection Method, Definite Working Day Method).

Tempering Air — Ambient air added to the combustion gases for cooling by dilution. Also called Cooling Air.

Theoretical Air — The exact amount of air required to supply oxygen for complete combustion of a given quantity of a specific fuel.

Thermal Conductivity — The specific rate of heat flow per hour through refractories, expressed in BTU per square foot of area, for a temperature difference of one degree Farenheit, and for a thickness of one inch. Expressed BTU (sq ft) (hr) (°F) (in).

Thermal Efficiency — The ratio of heat utilized usefully to total heat generated; heat output divided by heat input.

Thermal Shock Resistance — The ability to withstand sudden heating or cooling without cracking or spalling.

Thermocouple — Two lengths of wire made from different homogeneous metals and connected to form a complete electrical circuit which develops an electromotive force (emf) when one junction has a different temperature than the other.

Thermophiles — Bacteria or other microorganisms which grow best at temperatures of roughly 45° to 60°C. Not to be confused with thermodurics which resist high temperatures. Others: mesophiles — grow best at medium temperatures, 25° to 40°C; psychrophiles — grow best at colder temperatures, below 20°C.

Tidal Marsh — Low, flat marshlands traversed by interlacing channels and tidal sloughs and subject to tidal inundation. Vegetation usually consists of rushes and other salt-tolerant grasses and plants.

Tipping Floor — Unloading area for vehicles delivering refuse to an incinerator or transfer station.

Tons Per Day (Incineration) — Denotes the weight of refuse which can be processed properly by an incinerator within a 24-hour period.

Topsoil — The topmost layer of earth, usually referred to as soil containing humus, which is capable of supporting plant life.

Torque, Full Load — The torque necessary for a motor to produce its rated horsepower at full-load speed.

Total Cost Bidding — A method of establishing the purchase price for movable equipment whereby the buyer is guaranteed that maintenance shall not exceed a set maximum amount during a fixed period of time (generally five years) and that the equipment will be repurchased by the seller at a set minimum price at the end of the period agreed upon.

Train System — A collection system consisting of a series of (usually three to five) wheeled containers of about 4-to-9 cubic yards capacity, open at the top or covered by tarps and towed by a light truck. The containers are emptied into a compactor collection vehicle on the route or are towed directly to the disposal site.

Transfer Station — A supplemental transportation system used as an adjunct to route collection vehicles to reduce haul costs or add flexibility to the operation. A typical sytem has facilities in which route vehicles empty into a larger hopper from which open semi-trailers of about 40 cubic yards capacity, railroad gondolas, or barges are filled. There may be some compaction of refuse. Transfer stations may be fixed or mobile, as some of the larger compacting collection vehicles serve this function.

Travel Time — The elapsed or cumulative time of travel between collection stops on the refuse pickup route.

Tuyeres — Air openings or ports in a forced-draft gate.

Unconventional Wastes — Hazardous wastes by reason of their pathological, explosive, radioactive or toxic nature. Also called Special Wastes.

Underfire Air — Any air controlled with respect to quantity and direction, forced or induced, supplies beneath the grate, that passes through the fuel bed.

Underground Runoff (Seepage) — Water flowing toward stream channels after infiltration into the ground.

Utility, Private — A firm providing service under a government-issued license or monopoly franchise. Such an entity may collect and dispose of solid wastes.

Van Mannen Process — Anaerobic composting process which is a modification of the Indore method used in the Netherlands from about 1932. Urban refuse is heaped in long rows and moistened. Decomposition takes about six months.

Vapor Plume — The stack effluent consisting of flue gas made visible by condensed water droplets or mist.

Vapors — The gaseous form of substances which normally are in a solid or liquid state and which can be changed into these states either by increasing the pressure or decreasing the temperature alone.

Vector (of Disease) — A living insect or other arthropod, or animal (not human) which transmits infectious disease from one person or animal to another.

Vehicle (of Infection) — Water, food, milk or any substance or article serving as an intermediate means by which the pathogenic agent is transported from a reservoir and introduced into a susceptible host through ingestion, through inoculation or by deposit on the skin or mucous membrane.

Vermin — Carriers of disease germs, bacteria or viruses, such as rodents, mosquitoes, flies, lice and fleas, which transmit such infectious elements to humans.

Vitrification — A process of permanent chemical and physical change in a ceramic body at high temperatures, with the development of a substantial proportion of glass.

Volatile Matter of Refuse — The weight loss of a dry sample on heating to red heat in a closed crucible.

Volatile, Solids — The sum of the volatile matter and fixed carbon of a refuse sample, as determined by allowing a dried sample to burn in a heated and ventilated furnace.

Wall, Air-Cooled — A wall in which there is a lane for the flow of air directly in back of the refractory.

Wall, Battery — A double or common wall between two incinerators, both faces of which are exposed to heat.

Wall, Bridge — A partition wall between chambers over which pass the products of combustion. Also called a Curtain Wall.

Wall, Core — In a battery wall, those courses of brick, none of which are exposed on either side.

Wall, Curtain — A partition wall between combustion chambers which serves to deflect gases in a downward direction. Sometimes referred to as a Drop Arch.

Wall, Refractory — A wall made of refractory material.

Wall, Sectionally Supported — A furnace or boiler wall which consists of special refractory blocks or shapes that are mounted on and supported at intervals of height by metallic hangars. Also known as Suspended Wall.

Wall, Supported — A furnace wall that is anchored to and has its weight transferred to a structure, usually steelwork and castings, outside of the high-temperature zone.

Wall, Unit Suspended — A furnace wall or panel which is supported by hanging from overhead steel.

Wall, Water-Cooled — A furnace wall containing water tubes.

Wastes — Useless, unwanted or discarded material resulting from normal community activities. Wastes include solids, liquids and gases. Solid wastes are classed as refuse.

Wastes, Bulky — Large items of refuse such as appliances, furniture, junked auto parts, trees and branches, palm fronds, stumps, flotage, etc.

Wastes, Construction and Demolition — Refuse building materials and rubble resulting from construction, remodeling, repair and demolition operations on houses, commercial buildings, pavements or other structures.

Wastes Handling — The storage, collection, transportation and disposal of refuse.

Wastes, Hazardous — Refuse that can cause serious injury or infection during the normal storage, collection and disposal cycle.

Wastes Processing — An operation in which the physical or chemical properties of refuse is changed. Examples include compaction, composting and incineration.

Wastes Sources — Those activities including domestic, commercial, municipal and industrial — which generate refuse.

Watershed — Total land area above a given point on a stream or waterway that contributes runoff to that point.

Water Table — The surface or underground gravity-controlled water.

Water Table, Perched — Underground water lying over unsaturated soil and sealed from it by an impervious layer or membrane.

Wet Digestion — A solid wastes stabilization process proposed by Dr. William Oswald of the University of California, on the basis of experience with anaerobic sewage lagoons. A wide variety of mixed solid organic wastes is placed in an open digestion pond to decompose anaerobically. Much of the carbonaceous matter is converted into carbon dioxide and methane. The soluble and suspended fraction is converted aerobically by algae in a biooxidation pond.

Wet Milling — Mechanical size reduction of solid wastes after it has been wetted to soften the paper and cardboard constituents.

Windbox — A chamber below a grate or surrounding a burner, through which air under pressure is supplied for combustion fuel.

Working Face — That portion of the compacted solid wastes at a sanitary landfill which will have more refuse placed upon it or is being compacted prior to placement of cover material.

Yard Rubbish — Prunings, grass clippings, weeds, leaves and general yard and garden wastes.

Zoonosis — A disease of animals transmissible to man. Some examples are: anthrax, bubonic plague, murine typhus, some of the salmonellae.

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APPENDIX

ENVIRONMENTAL PROTECTION AGENCY

Proposed Guidelines for Land Disposal of Solid Wastes

Reprinted from the
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PART 241—GUIDELINES FOR THE LAND DISPOSAL OF SOLID WASTES

Subpart A—General Provisions

Subpart B—Requirements and Recommended Procedures

Appendix—Recommended Bibliography

Authority.—Sec. 209 (a) of the Solid Waste Disposal Act of 1965 (Public Law 89-272) as amended by the Resource Recovery Act of 1970 (Public Law—512).

PROPOSED RULES

Subpart A—General Provisions

§ 241.100 Scope.

(a) These guidelines are intended to provide for land disposal site operations that will have minimal impact on the environment. The guidelines do not establish new standards but set forth requirements and recommended procedures to ensure that the design, construction, and operation of both existing and future land disposal sites meet the health and environmental standards for the area in which they are located. They incorporate the concept that the operator of a land disposal site must meet the most stringent standards that are legally applicable to the operation of the site. Pursuant to section 211 of the Solid Waste Disposal Act, as amended, these guidelines are mandatory for Federal agencies. In addition they are recommended to State, interstate, regional, and local government agencies for use in their activities.

(b) The requirement sections contained herein delineate minimum levels of performance required of any solid waste land disposal site operation. The recommended procedures sections are presented to suggest preferred methods by which the objectives of the requirements can be realized.[1] The recommended procedures are based on the practice of sanitary landfilling municipal solid waste; normally residential, and commercial solid waste generated within a community. Sanitary landfilling is the most widely applied environmentally acceptable land disposal method. If techniques other than the recommended procedures are used, or wastes other than municipal solid wastes are disposed, it is the obligation of the proposed facility's owner and operator to demonstrate to the responsible agency in advance that the techniques employed will satisfy the requirements.

(c) The guidelines are considered to be generally applicable to the land disposal of all solid waste materials. However the guidelines do not apply to hazardous, agricultural, and mining wastes because of the lack of sufficient information upon which to base recommended procedures. Concerning the specific practice of land disposal of milled solid waste EPA guidance is contained in a position statement issued in November 1972.

§ 241.101 Definitions

As used in these guidelines:

(a) "Cell" means compacted solid wastes that are enclosed by natural soil or cover material in a land disposal site.

(b) "Cover material" means soil or other suitable material that is used to cover compacted solid waste in a land disposal site.

(c) "Daily Cover" means cover material that is spread and compacted on the top and side slopes of compacted solid waste at least at the end of each operating day in order to control vectors, fire, moisture, and erosion and to assure an aesthetic appearance.

(d) "Final cover" means cover material that serves the same functions as daily cover but, in addition, may be permanently exposed on the surface.

(e) "Free moisture" means liquid that will drain freely by gravity from solid materials.

(f) "Ground water" means water present in the saturated zone of an aquifer.

(g) "Hazardous wastes" means waste materials that are: (1) Toxic or poisonous; (2) Corrosive; (3) irritating or sensitizing; (4) radioactive; (5) biologically infectious; (6) explosive; or (7) flammable and that present a significant hazard to human health and the environment. They include, but are not limited to those materials and concentrations of materials that are determined to be toxic by the Secretary of Health, Education, and Welfare pursuant to section 20(6) of the Occupational Safety and Health Act of 1970 (Public Law 91-596).

[1]Further guidance may be found in the EPA publication, "Sanitary Landfill Design and Operation," which served as a basis for the development of these guidelines.

(h) "Infectious waste" means: (1) Equipment, instruments, utensils, and fomites of a disposable nature from the rooms of patients who are suspected to have or have been diagnosed as having a communicable disease and must, therefore, be isolated as required by public health agencies; (2) laboratory wastes, including pathological specimens (i.e., all tissues, specimens of blood elements, excreta, and secretions obtained from patients or laboratory animals) and disposalbe fomites (any substance that may harbor or transmit pathogenic organisms) attendant thereto; (3) surgical operating room pathologic specimens and disposable materials from outpatient areas and emergency rooms.

(i) "Intermediate cover" means cover material that serves the same functions as daily cover, but must resist erosion for a longer period of time, because it is applied on areas where additional cells are not to be constructed for extended periods of time.

(j) "Leachate" means liquid that has percolated through solid waste and has extracted dissolved or suspended materials from it.

(k) "Municipal solid wastes" means normally, residential, and commercial solid waste generated within a community.

(l) "Open burning" means burning of solid wastes in the open, such as in an open dump.

(m) "Open dump" means a land disposal site at which solid wastes are disposed of in a manner that does not protect the environment, is susceptible to open burning, and is exposed to the elements, vectors, and scavengers.

(n) "Plans" means reports and drawings, including a narrative operating description, prepared to describe the land disposal site and its proposed operation.

(o) "Residue" means all the solids that remain after completion of thermal processing, including bottom ash, fly ash, and grate siftings.

(p) "Responsible agency" means the organizational element that has the legal duty to ensure that owners, operators, or users of land disposal sites comply with these guidelines.

(q) "Runoff" means the portion of precipitation that drains from an area as surface flow.

(r) "Salvaging" means the controlled removal of waste materials for utilization.

(s) "Sanitary landfill" means a land disposal site employing an engineered method of disposing of solid wastes on land in a manner that minimizes environmental hazards by spreading the solid wastes to the smallest practical volume, and applying cover material at the end of each operating day.

(t) "Scavenging" means uncontrolled removal of solid waste materials.

(u) "Sludge" means the accumulated semiliquid suspension of settled solids deposited from waste waters or other fluids in tanks or basins.

(v) "Solid wastes" means garbage, refuse, sludges, and other discarded solid materials resulting from industrial, commercial, and agricultural operations and from community activities. It does not include solids or dissolved material in domestic sewage or other significant pollutants in water resources, such as silt, dissolved or suspended solids in industrial waste water effluents, dissolved materials in irrigation return flows or other common water pollutants.

(w) "Vector" means a carrier, usually an arthropod, that is capable of transmitting a pathogen from one organism to another.

(x) "Water table" means the upper water level of a body of ground water.

(y) "Working face" means that portion of the land disposal site where solid wastes are discharged and are spread and compacted prior to the placement of cover material.

Subpart B—Requirements and Recommended Procedures

§241.200 Solid wastes accepted.

§241.200—1 Requirement.

In consultation with the responsible agencies, the designer and owner/operator shall determine what wastes shall be accepted and shall identify any special handling required. Only wastes for which the facility has been specifically designed shall be accepted.

§ 241.200—2 Recommended procedures: Design.

The plans should specify the procedures to be employed for wastes requiring special handling.

§ 241.200—3 Recommended procedures:Operations.

(a) Routine sanitary landfill techniques of spreading and compacting solid wastes and placing cover material at the end of each operating day should be used to dispose of municipal solid wastes.

(b) Certain bulky wastes, such as automobile bodies, furniture, and appliances, should be crushed on solid ground and then pushed onto the working face near the bottom of the cell. Other bulky items, such as demolition and construction debris; tree stumps, and large timbers, should be pushed onto the working face near the bottom of the cell.

(c) Procedures for disposing of dead animals have been established by law in most States, and the operation should comply accordingly. In most cases, small carcasses should be placed on the working face with other municipal solid wastes and covered immediately. In the absence of applicable State laws, large carcasses should be placed in a pit and provided with a cover of compacted soil or other suitable material.

(d) Water treatment plant sludges containing no free moisture and digested waste water treatment plant sludges containing no free moisture should be placed on the working face along with municipal solid wastes and covered with soil or municipal solid wastes. The quantities accepted should be determined by operational problems encountered at the working face.

(e) Incinerator and air pollution control residues should be incorporated into the working face and covered at such intervals as necessary to prevent them from becoming airborne.

§ 241.201 Solid waste excluded.

§ 241.201—1 Requirement

Using information supplied by the waste generator/owner, the responsible agency, the disposal site owner/operator and designer shall jointly determine specific wastes to be excluded and shall identify them in the plans. The generator/owner of excluded wastes and the responsible agency shall jointly determine an alternative method of disposal for excluded wastes. The criteria used to determine whether a waste is unacceptable shall include the hydrogeology of the site, the chemical and biological characteristics of the waste, and the safety of personnel. Disposal of pesticides and pesticide containers shall be consistent with the Federal Environmental Pesticides Control Act of 1972 (Public Law 92-516) and recommended procedures and regulations promulgated thereunder.

§ 214.201—2 Recommended procedures: Design.

Under certain circumstances it may be necessary to accept special wastes at land disposal sites. The following special wastes require specific approval for acceptance at the site by the responsible agency: Hazardous wastes, infectious institutional wastes, bulk liquids and semi-liquids, sludges containing free moisture, highly flammable or volatile substances, raw animal manure, septic tank pumpings, raw sewage sludge, and certain industrial process wastes. Where the use of the disposal site for such wastes is planned, a special assessment is required of the following items: The site characteristics, nature and quantities of the waste, and special design and operations precautions to be implemented to ensure environmentally safe disposal.

§ 241.201—3 Recommended procedures: Operations.

Regular users of the land disposal site should be provided with a list of the materials to be excluded. The list should also be displayed prominently at the site entrance. If a regular user persists in making unacceptable deliveries, he should be barred from the site and reported to the responsible agency.

§ 241.202 Site selection.

§ 241.202—1 Requirement.

Site selection and utilization shall comply with appropriate Federal, State, or local health, environmental, planning, and solid waste management agency requirements and plans.

§ 241.202—2 Recommended procedures: Design.

(a) Site development plans should be prepared or approved by a professional engineer and should include:

(1) Initial and final topographies at contour intervals of 5 feet or less.

(2) Land use and zoning within one-quarter mile of the site including location of all residences, buildings, wells, water courses, arroyos, rock outcroppings, roads, and soil or rock borings. All airports within 5 miles of the site should be identified to aid in assessing the potential hazard of birds to aircraft.

(b) Plans should describe the projected use of the completed land disposal site. In addition to maintenance programs and provisions, where necessary, for monitoring and controlling decomposition gases and leachate, the plans should address the following ultimate use criteria:

(1) *Cultivated area.*— The major concern if the completed site is to be cultivated is that the integrity of the final cover not be disturbed by agricultural cultivation activities. In this regard, a sufficient depth of cover material to allow cultivation and to support vegetation should be applied in addition to that recommended for final cover.

(2) *Structures.*— It is not recommended practice to construct major structures on a completed land disposal site. If major structures are to be built near a completed land disposal site, a professional engineer should approve their design and construction including provision for protection against potential hazards of solid waste decomposition gases.

(c) The hydrogeology of the site should be evaluated in order to design site development in a manner to protect or minimize the impact on ground water resources. Unacceptable hydrogeolic conditions may be altered to render the site acceptable, but all alterations should be detailed in the plans. Precipitation, evapotranspiration, and other climatological conditions should be considered in site selection and design.

(d) Characteristics of on-site soil should be evaluated with respect to their effects on site operations, such as vehicle manuverability.

(e) Environmental factors, climatological conditions, and socioeconomic factors should be given full consideration as selection criteria.

§ 241.202—3 Recommended procedures: Operations.

(a) The site should be accessible to vehicles which the site is designed to serve by all-weather roads leading from the public road system; temporary roads should be provided as needed to deliver wastes to the working face.

(b) The site should not be located in an area where the attraction of birds would pose a hazard to low-flying aircraft.

§ 241.203 Design.

§ 241.203—1 Requirement.

Plans for the design, construction, and operation of the site shall be prepared or approved by a professional engineer. The plans shall be submitted to the responsible agency for review and, if warranted, approval.

§ 241.203—2 Recommended procedures: Design.

Not applicable.

§ 241.203—3 Recommended procedures: Operations.

Not applicable.

§ 241.204 Water Quality.

§ 241.204—1 Requirement.

The location, design, construction, and operation of the land disposal site shall minimize environmental hazards and shall conform to the most stringent of applicable ground and surface water quality standards and requirements. Applicable standards are existing Federal, State, or local standards that are legally enforceable.

§ 241.204—2 Recommended procedures: Design.

(a) Plans should include:

(1) Current and projected use of water resources in the potential zone of influence of the land disposal site.

(2) Ground water elevation and movement and proposed separation between the lowest point of the lowest cell and the predicted maximum water table elevation.

(3) Potential interrelationship of the land disposal site, local aquifers, and surface waters based on historical records or other sources of information.

(4) Background and initial quality of water resources in the potential zone of influence of the land disposal site.

(5) Proposed location of observation wells, sampling stations, and testing program planned, when appropriate.

(6) Description of soil and other geologic material to a depth adequate to allow evaluation of the water quality protection provided by the soil and other geologic material.

(7) Provision for surface water runoff control to minimize infiltration and erosion of cover material.

(8) Potential of leachate generation and proposed control systems, where necessary, for the protection of ground and surface water resources.

(b) If a land disposal site is located in a flood plain, it should be protected against at least the 50-year design flood by impervious dikes and other appropriate means to prevent the floodwaters from contacting municipal solid waste.

§ 241.204—3 Recommended procedures: Operations.

(a) Surface water courses and runoff should be diverted from the land disposal site (especially from the working fact) (sic) by devices such as trenches, conduits, and proper grading. The land disposal site should be constructed and graded so as to promote rapid surface water runoff without excessive erosion. Regrading should be done as required during construction and after completion to avoid ponding of precipitation and to maintain cover material integrity.

(b) Leachate collection and treatment systems should be used where necessary to protect ground and surface water resources.

(c) Municipal solid wastes and leachate therefrom should not be allowed to contact ground or surface water so as to impair the water's use.

§ 241.205 Air Quality.

§ 241.205—1 Requirement.

The design, construction, and operation of the land disposal site shall minimize environmental hazards and shall conform to the most stringent of applicable ambient air quality standards and source control regulations.

§ 241.205—2 Recommended procedures: Design.

Plans should include an effective dust control program.

§ 241.205—3 Recommended procedures: Operations.

Open burning of municipal solid waste should be prohibited.

§ 241.206 Gas control.

§ 241.206—1 Requirement.

Decomposition gases generated within the land disposal site shall be controlled on site, as necessary, to avoid posing a hazard to occupants of adjacent property.

§ 241.206—2 Recommended procedures: Design.

Plans should assess the need for gas control and indicate the location and design of any vents, barriers, or other control measures to be provided.

§ 241.206—3 Recommended procedures: Operations.

(a) Decomposition gases should not be allowed to migrate laterally from the land disposal site to endanger occupants of adjacent properties. They should be vented to the atmosphere, directly through the cover material, cutoff trenches, or ventilation systems in such a way that they do not accumulate in explosive or toxic concentrations, especially within structures. (Information on the limits of flammability of gases is available in such references as the "Handbook of Chemistry and Physics" 44th ed. Cleveland, Chemical Rubber Publishing

Co., 1962, 3604pp.)

(b) Decomposition gases should not be allowed to concentrate in a manner that will pose an explosion or toxicity hazard.

§ 241.207 Vectors

§ 241.207—1 Requirement.

Conditions shall be maintained that are unfavorable for the harboring, feeding, and breeding of vectors.

§ 241.207—2 Recommended procedures: Design.

Plans should include contingency programs for vector control, and the operator should be prepared at all times to implement those procedures.

§ 241.207—3 Recommended procedures: Operations.

Vector control contingency programs should be implemented when necessary to prevent or rectify vector problems.

§ 241.208 Esthetics

§ 241.208—1 Requirement.

The land disposal site shall be designed and operated at all times in an esthetically acceptable manner.

§ 241.208—2 Recommended procedures: Design.

Plans should include an effective litter control program.

§ 241.208—3 Recommended procedures: Operations.

(a) Portable litter fences or other devices should be used in the immediate vicinity of the working face and at other appropriate locations to control blowing litter. At the end of each operating day, or more often as required, litter should be removed from the fences and incorporated into the cell being used. Alternatively, the litter may be containerized for disposal on the next operating day.

(b) Wastes that are easily moved by wind should be covered, as necessary, to prevent their becoming airborne and scattered.

(c) On-site vegetation should be cleared only as necessary. Natural windbreaks, such as green belts, should be maintained where they will improve the appearance and operation of the land disposal site.

(d) Salvage operations should be conducted in such a manner as to not detract from the appearance of the land disposal site. Salvaged material should be removed from the land disposal site frequently enough to maintain aesthetic acceptability.

§ 241.209 Cover material.

§ 241.209—1 Requirement.

Cover material shall be applied as necessary to minimize fire hazards, infiltration of precipitation, odors, and blow litter; control gas venting and vectors; discourage scavenging; and provide a pleasing appearance.

§ 241.209—2 Recommended procedures: Design.

Plans should specify:

(a) Cover material sources and soil classifications (Unified Soil Classification System or U.S. Department of Agriculture Classification System).

(b) Surface grades and side slopes needed to promote maximum runoff, without excessive erosion, to minimize infiltration.

(c) Procedures to promote vegetative growth as promptly as possible to combat erosion and improve appearance of idle and completed area.

(d) Procedures to maintain cover material integrity, e.g., regrading and recovering.

§ 241.209—3 Recommended procedures: Operations.

(a) Daily cover should be applied regardless of weather; sources of cover material should, therefore, be accessible on all operating days. The thickness of the compacted daily cover should not be less than 6 inches.

(b) Intermediate cover should be applied on areas where additional cells are not to be constructed for extended periods of time. The thickness of the compacted intermediate cover should not be less than 1 foot.

(c) Final cover should be applied on each area as it is completed. The thickness of the compacted final cover should not be less than 2 feet.

§ 241.210 Compaction

§ 241.210—1 Requirement.

In order to conserve land disposal site capacity, thereby preserving land resources, and to minimize moisture infiltration and settlement, municipal solid waste and cover material shall be compacted to the smallest practicable volume.

§ 241.210—2 Recommended procedures: Design.

(a) Arrangements should be made and indicated in the plans whereby substitute equipment will be available to provide uninterrupted service during routine maintenance periods or equipment breakdowns.

(b) An equipment maintenance facility should be provided onsite or appropriate contract arrangements should be made to receive such service.

(c) Equipment manuals, catalogs, and spare parts lists should be compiled and readily available onsite.

§ 241.210—3 Recommended procedures: Operations.

(a) Municipal solid waste handling equipment should, on any operating day, be capable of performing the following functions on a slope not flatter than one (vertical) to three (horizontal):

(1) Spread the solid wastes accepted in layers no more than 2 feet thick while confining it to the smallest practicable area;

(2) Compact the spread solid wastes to the smallest practicable volume; and

(3) Place, spread, and compact the cover material.

(b) A preventive maintenance program should be employed to maintain equipment in operating order.

(c) An operating manual describing the various tasks that must be performed during a typical shift should be available to employees for reference.

§ 241.211 Safety.

§ 241.211—1 Requirement.

The land disposal site shall be designed, constructed, and operated in such a manner as to protect the health and safety of personnel associated with the operation. Pertinent provisions of the Occupational Safety and Health Act of 1970 (Public Law 91-596) and regulations promulgated thereunder shall apply.

§ 241.211—2 Recommended procedures: Design.

A manual describing safety precautions and procedures to be employed should be developed.

§ 241.211—3 Recommended procedures: Operations.

(a) A safety manual should be available for use by employees, and they should be instructed in application of its procedures.

(b) Safety devices, including but not limited to, rollover protective structures, seatbelts, audible reverse warning devices, and fire extinguishers should be provided on all solid waste handling equipment.

(c) Provision should be made to extinguish any fires in wastes being delivered to the site or which occur at the working face or within equipment or personnel facilities.

(d) Communications equipment should be available on site for emergency situations.

(e) Scavenging should be prohibited at all times to avoid injury and to prevent interference with site operations.

(f) Access to the site should be controlled and should be by established roadways only. The site should be accessible only when operating personnel are on duty. Large containers may be placed at the site entrance so that users can conveniently deposit waste after hours. The containers and the areas around them should be maintained in a sanitary and litter-free condition.

(g) Traffic signs or markers should be provided to promote an orderly traffic pattern to and from the discharge area and, if necessary, to restrict access to hazardous areas or to maintain efficient operating conditions. Drivers of manually discharging vehicles should not hinder operation of mechanically discharging vehicles. Vehicles should not be left unattended at the working face or along traffic routes. If a regular user persistently

poses a safety hazard, he should be barred from the site and reported to the responsible agency.

§ 241.212 Records.

§ 241.212—1 Requirement.

The owner/operator of the land disposal site shall maintain records and monitoring data to be provided, as required, to the responsible agency.

§ 241.212—2 Recommended procedures: Design.

Where necessary, plans should prescribe methods to be used in maintaining records and monitoring the environmental impact of the land disposal site. Information on recording and monitoring requirements should be obtained from the responsible agency.

§ 241.212—3 Recommended procedures: Operations.

(a) Records should be maintained covering at least the following:

(1) Major operational problems, complaints, or difficulties.

(2) Qualitative and quantitative evaluation of the environmental impact of the land disposal site with regard to the effectiveness of gas and leachate control, including results of: (i) Leachate sampling and analyses; (ii) gas sampling and analyses; (iii) ground and surface water quality sampling and analyses upstream and downstream of the site.

(3) Vector control efforts.

(4) Dust and litter control efforts.

(5) Quantitative measurements of the solid wastes handled. This should be accomplished through routine or periodic utilization of scales and topographic surveys.

(6) Description of solid waste materials received, identified by source of material.

(b) Upon completion of the site, a detailed, description, including a plat, should be recorded with the area's land recording authority. The description should include general types and locations of wastes, depth of fill, and other information of interest to potential landowners.

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CREDITS

AUTHOR	Thomas M. Meichtry Easley & Brassy Corp. San Francisco
EDITOR	Barbara E. Witte Berkeley
MAPS	Joseph A. Mastainich Redwood City
GRAPHICS & PRINTING	D.R. Lann Burlingame
PHOTOGRAPHS	As Credited
COMPUTER ANALYSIS	Dennis L. Bayer Richard Bernstein Sausalito

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